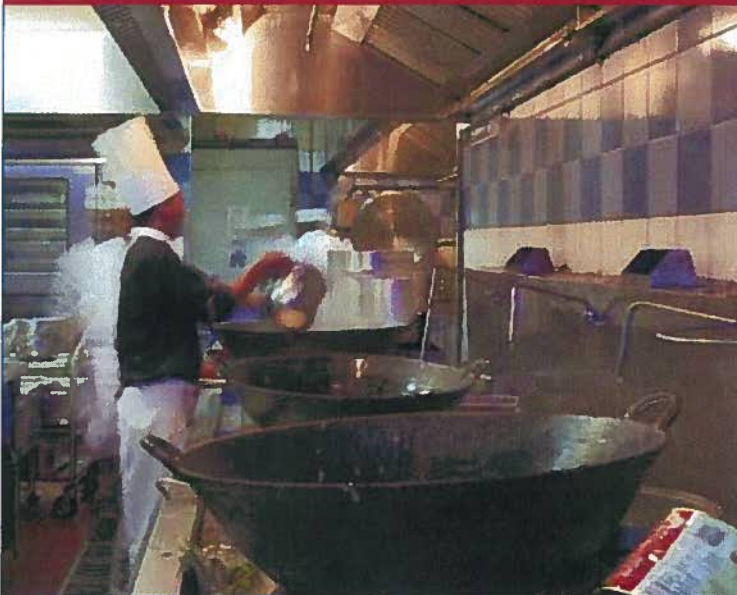


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# Commercial Kitchen Equipment

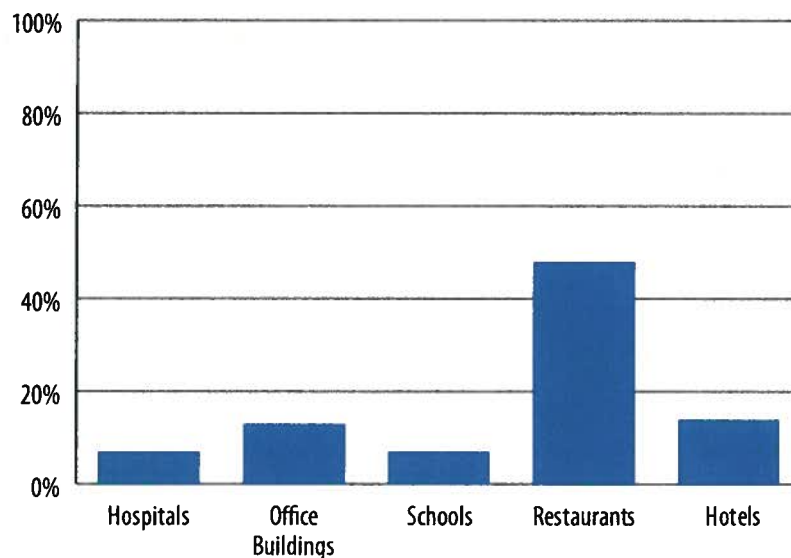


## 4.1 Introduction to Commercial Kitchen Equipment



In restaurants, water use in the kitchen can account for nearly 50 percent of the facility's total water use. Several other commercial and institutional sectors, including hospitals, offices, schools, and hotels, also have substantial kitchen water use that accounts for as much as 10 to 15 percent of the facility's total water use.<sup>1</sup> Figure 4-1 shows the percentage of facility water use that is attributed to kitchen equipment for various commercial facility types.<sup>2</sup>

**Figure 4-1. Water Use Attributed to Commercial Kitchen Equipment**



The type and water use of commercial kitchen equipment will vary depending upon the scope and scale of the kitchen's operations. A kitchen in an office building, for example, may only have a kitchen faucet and a small undercounter dishwasher. Commercial-style kitchens found in food service establishments, such as standalone and hotel restaurants or hospital and school cafeterias, on the other hand, may use water in almost every aspect of their operation, from food preparation to dish cleaning. These types of kitchens may also have much larger and more water-intensive commercial kitchen equipment.

In most commercial kitchens, the commercial dishwasher and pre-rinse spray valve account for over two-thirds of the water use.<sup>3</sup> However, the presence of a sluice trough food disposal system or boiler-based food preparation equipment, such as combination ovens, steam kettles, and steam cookers, can dwarf this water use.

<sup>1</sup> Fisher, Don. Food Service Technology Center. 2006. "Energy & Water Savings in Commercial Food Service." [www.cuwcc.org/products/commercial-food-services-main.aspx](http://www.cuwcc.org/products/commercial-food-services-main.aspx).

<sup>2</sup> Created from analyzing data in: Schultz Communications. July 1999. *A Water Conservation Guide for Commercial, Institutional and Industrial Water Users*. Prepared for the New Mexico Office of the State Engineer. [www.ose.state.nm.us/wucp\\_ici.html](http://www.ose.state.nm.us/wucp_ici.html); Dziegielewski, Benedykt, et al. American Water Works Association (AWWA) and AWWA Research Foundation. 2000. *Commercial and Institutional End Uses of Water*; East Bay Municipal Utility District. 2008. *WaterSmart Guidebook: A Water-Use Efficiency Plan Review Guide for New Businesses*. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook); AWWA. *Helping Businesses Manage Water Use—A Guide for Water Utilities*.

<sup>3</sup> Alliance for Water Efficiency. Commercial Dishwashing Introduction. [www.allianceforwaterefficiency.org/commercial\\_dishwash\\_intro.aspx](http://www.allianceforwaterefficiency.org/commercial_dishwash_intro.aspx).

## 4.1 Introduction to Commercial Kitchen Equipment

In addition, specialty equipment, such as dipper wells found in ice cream and coffee shops and wok stoves found in Asian-style restaurants, can be among the largest water-using commercial kitchen equipment if standard, inefficient equipment is installed. These typically discharge water continuously during operation, consuming hundreds of thousands of gallons per year.

Because water use from commercial kitchens can account for a large percent of total facility water use, and a majority of that water is heated using facility energy, ensuring commercial kitchen equipment uses water efficiently affords both significant water and energy savings. Newer technologies and better practices are available that can significantly reduce commercial kitchen equipment water and energy use. For example, ENERGY STAR® qualified dishwashers,<sup>4</sup> ice machines, and steam cookers are at least 10 percent more water-efficient and 15 percent more energy-efficient than standard models, with some models saving significantly more. Efficient dipper wells and waterless wok stoves can use 50 to 90 percent less water than standard models.

*Section 4: Commercial Kitchen Equipment of WaterSense at Work* provides an overview of and guidance for effectively reducing the water use of:

- Commercial ice machines
- Combination ovens
- Steam cookers
- Steam kettles
- Wok stoves
- Dipper wells
- Pre-rinse spray valves
- Food disposals
- Commercial dishwashers
- Wash-down sprayers

### Commercial Kitchen Equipment Case Study

To learn how three restaurants in Chicago, Illinois; Omaha, Nebraska; and Washington, D.C. saved water and energy by implementing several of the best management practices discussed in this section, read the case study in Appendix A.



<sup>4</sup> U.S. Environmental Protection Agency and U.S. Energy Department's ENERGY STAR. Dishwashers. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=DW](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DW).

## 4.2 Commercial Ice Machines

### Overview

Commercial ice machines use refrigeration units to freeze water into ice for cooling or preserving food and other items. Ice machines have become a mainstay in all types of settings, including restaurants, commercial kitchens, fast food establishments, convenience stores, grocery stores, schools, hotels, hospitals, and laboratories. Ice machines typically use water for two purposes: cooling the refrigeration unit and making ice. There are mechanisms to address the efficiency of both aspects.



*Cubed ice machine*

Because the ice-making process generates a significant amount of heat, either water or air is used to remove this waste heat from the ice machine's refrigeration unit. In the most basic configuration, water-cooled ice machines pass water through the machine once to cool it, and then dispose of the single-pass water down the drain. Water-cooled systems can use less water by recirculating the cooling water through a chiller or a cooling tower to lower the temperature, returning the water to the machine for reuse. To eliminate using water to cool the refrigeration unit altogether, air can be used to cool the unit instead. Air-cooled ice machines use motor-driven fans or centrifugal blowers to move air through the refrigeration unit to remove heat.<sup>5</sup>

There are three primary types of ice machines: ice-making head units, self-contained units, and remote condensing units. Ice-making head units include the ice-making mechanism and the condenser unit in a single package, and the ice storage bins are sold separately. Self-contained units have the ice-making mechanism, condenser unit, and a built-in storage bin in an integral cabinet. These units are typically small, undercounter units that produce a smaller volume of ice. Remote condensing units are models with the ice-making mechanism

and the condenser unit in a separate section. They transfer the heat generated by the ice-making process outside the building.

Regardless of how the machine is cooled, all ice machines use water to produce ice. If a machine were 100 percent water-efficient and wasted no water when producing ice, the machine would use approximately 12 gallons of water to produce 100 pounds of ice.<sup>6</sup> However, in order to create ice of acceptable quality, some water is used and sent down the drain during the process. The amount of water used for the ice-making process depends upon the facility's incoming water quality and on the desired end quality of the ice. Specifically, water is used to rinse ice-making surfaces and flush minerals that accumulate as water crystallizes into ice.

As ice is formed in the freezing trays, minerals in the water collect on the equipment and must be rinsed occasionally. Ice machines at facilities with poorer incoming water quality (i.e., incoming potable water that contains high total dissolved solids or minerals) will require more frequent rinse cycles. Some ice machines might be set

<sup>5</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Commercial Ice Machines. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=CIM](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CIM).

<sup>6</sup> Alliance for Water Efficiency (AWE). Ice Machines. [www.allianceforwaterefficiency.org/Ice\\_Machines.aspx](http://www.allianceforwaterefficiency.org/Ice_Machines.aspx).



## 4.2 Commercial Ice Machines

to rinse more frequently than needed, not taking into account the facility's incoming water quality and resulting in wasted water.

In addition to equipment rinsing, some facilities require a higher quality of ice than other facilities, depending upon the end use of the ice. A restaurant serving ice in beverages, for example, might want very clear, high-quality ice, while a cafeteria using ice to cool prepared food in a display case might not be concerned with the clarity of the ice used. Some ice machines are designed to produce clearer and smoother ice using a repeated freezing and partial thawing process. This method produces ice with fewer air bubbles and is more crystalline, but the process uses more water.<sup>7</sup>

The types of ice that ice machines can make include:

- Cubed ice—clear, regularly shaped ice weighing up to 1.5 ounces per piece and containing minimal amounts of liquid water.
- Flake ice—chips or flakes of ice containing up to 20 percent liquid water by weight.
- Crushed ice—small, irregular pieces made by crushing bigger pieces of ice.
- Nugget ice—small portions of ice created by extruding and freezing the slushy flake ice into a nugget.<sup>8</sup>



Crushed ice machine

Cubed ice machines are the most prominent in the market, accounting for approximately 80 percent of ice machine sales in the United States.<sup>9</sup> Most cubed ice machines use more water than flake ice machines because they run more water over the freezing ice to remove sediment and minerals left as the water freezes. In general, the higher the quality of ice, the more water is needed for the ice-making process.

Water used for the ice-making process ranges from 15 gallons to more than 50 gallons per 100 pounds of ice,<sup>10</sup> depending upon the amount of water used to rinse the ice-making surfaces and the amount of water needed to produce higher quality ice.

In total, including the ice-making and cooling processes, water-cooled ice machines with single-pass cooling consume between 100 and 300 gallons of water per 100 pounds of ice produced,<sup>11</sup> while air-cooled ice machines can consume less than 50 gallons of water per 100 pounds of ice produced. While air-cooled machines are usually more water-efficient, water-cooled machines are usually more energy-efficient. Some air-cooled units, however, are able to match or exceed the energy efficiency of water-cooled units while also providing substantial water efficiency.<sup>12</sup>

<sup>7</sup> *Ibid.*

<sup>8</sup> Pacific Gas and Electric Company. *Information Brief: Commercial Ice Machines*. [www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hospitality/icemachinetech.pdf](http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hospitality/icemachinetech.pdf).

<sup>9</sup> *Ibid.*

<sup>10</sup> Koeller, John and Hoffman, H. W. (Bill). Koeller and Company. June 2008. *A Report on Potential Best Management Practices—Commercial Ice Machines*. Prepared for the California Urban Water Conservation Council. Page 6. [www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

<sup>11</sup> Bohlig, Charles M. East Bay Municipal Utility District. February 7, 2006. "Water Efficiency in Commercial Food Service." Slides 13-20. [www.awwa.org/Resources/Waterwiser.cfm?ItemNumber=33640&navItemNumber=3375](http://www.awwa.org/Resources/Waterwiser.cfm?ItemNumber=33640&navItemNumber=3375).

<sup>12</sup> AWE, *op. cit.*

## 4.2 Commercial Ice Machines

The U.S. Energy Department (DOE) sets energy and water use standards for ice machines under the Energy Policy Act (EPA) of 2005. Visit DOE's website for the most up-to-date information.<sup>13</sup>

To recognize energy- and water-efficient ice machines, the U.S. Environmental Protection Agency (EPA) and DOE's ENERGY STAR® issued a specification<sup>14</sup> to qualify certain types of commercial air-cooled ice machines that meet more stringent energy use and potable water use criteria. Commercial ice machines that are ENERGY STAR qualified are, on average, 15 percent more energy-efficient and 10 percent more water-efficient than standard air-cooled models.

### Operation, Maintenance, and User Education

For optimal ice machine efficiency, consider the following:

- Periodically clean the ice machine to remove lime and scale buildup; sanitize it to kill bacteria and fungi. For self-cleaning or sanitizing machines, run the self-cleaning option. For machines without a self-cleaning mode, shut down the machine, empty the bin of ice, add cleaning or sanitizing solution to the machine, switch it to cleaning mode, and then switch it to ice production mode. For health and safety purposes, create and discard several batches of ice to remove residual cleaning solution.
- Keep the ice machine's coils clean to ensure the heat exchange process is running as efficiently as possible.
- Keep the lid closed to keep cool air inside the ice machine and maintain the appropriate temperature.
- Install a timer to shift ice production to nighttime or off-peak hours. This will decrease the facility's peak energy demand.
- Keeping in mind local water quality and site requirements, work with the manufacturer to ensure that the ice machine's rinse cycle is set to the lowest possible frequency that still provides sufficient ice quality. If available, use the ice machine's ability to initiate rinse cycles based on sensor readings of minerals.
- Follow the manufacturer-provided use and care instructions for the specific model ice machine used at the facility.
- Train users to report leaking or otherwise improperly operating ice machines to the appropriate personnel.

### Retrofit Options

If the machine is cooled using single-pass water, modify the machine to operate on a closed loop that recirculates the cooling water through a cooling tower or heat

<sup>13</sup> DOE, Energy Efficiency & Renewable Energy. Building Technologies Program: Automatic Commercial Ice Makers. [www1.eere.energy.gov/buildings/appliance\\_standards/commercial/automatic\\_ice\\_making\\_equipment.html](http://www1.eere.energy.gov/buildings/appliance_standards/commercial/automatic_ice_making_equipment.html).

<sup>14</sup> EPA and DOE's ENERGY STAR. Commercial Ice Machines Key Product Criteria. [www.energystar.gov/index.cfm?c=comm\\_ice\\_machines.pr\\_crit\\_comm\\_ice\\_machines](http://www.energystar.gov/index.cfm?c=comm_ice_machines.pr_crit_comm_ice_machines).

## 4.2 Commercial Ice Machines

exchanger, if possible. If eliminating single-pass cooling is not feasible, consider reusing the cooling water for another application. See *Section 8: Onsite Alternative Water Sources* for more information.

### Replacement Options

When replacing an ice machine or installing a new one, ensure that the new model is sized appropriately to fit the facility's need. If the machine produces too large of a yield, water will be wasted by producing unnecessary ice. Choose an ice machine that is appropriate for the quality of ice needed. Producing ice of higher quality than required will use water unnecessarily. Look for ENERGY STAR qualified models,<sup>15</sup> all of which are air-cooled. Also consider air- or water-cooled ice machines that meet the efficiency specifications outlined by the Consortium for Energy Efficiency.<sup>16</sup> If feasible, consider selecting air-cooled flake or nugget ice machines, which use less water and energy than cubed ice machines.

### Savings Potential

A facility will see varying levels of water savings, depending upon whether it is replacing an existing air-cooled ice machine or an existing water-cooled model.

The Food Service Technology Center has a life cycle and energy cost calculator, which can be used to calculate the savings potential from replacing many types of commercial kitchen equipment, including commercial ice machines.<sup>17</sup>

To estimate facility-specific water savings and payback, the facility can also use the following information.

#### Air-Cooled Ice Machine Replacement

ENERGY STAR qualified ice machines are, on average, 15 percent more energy-efficient and 10 percent more water-efficient than standard air-cooled models. Total savings depend upon the type of machine selected.

Use ENERGY STAR's commercial kitchen equipment savings calculator<sup>18</sup> to estimate facility-specific water, energy, and cost savings for replacing an existing ice machine with an ENERGY STAR qualified model.

#### Water-Cooled Ice Machine Replacement

A facility will see the most water savings from replacing a water-cooled ice machine with an air-cooled model. When replacing an ice machine, select an ENERGY STAR qualified model.

<sup>15</sup> EPA and DOE's ENERGY STAR. Commercial Ice Machines, *op. cit.*

<sup>16</sup> Consortium for Energy Efficiency, Inc. Commercial Kitchens. [www.cee1.org/com/com-kit/com-kit-equip.php3](http://www.cee1.org/com/com-kit/com-kit-equip.php3).

<sup>17</sup> Food Service Technology Center. Commercial Foodservice Equipment Lifecycle Cost Calculator. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

<sup>18</sup> EPA and DOE's ENERGY STAR. Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment. [www.energystar.gov/ia/business/bulk\\_purchasing/bpsavings\\_calc/commercial\\_kitchen\\_equipment\\_calculator.xls](http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls).

## 4.2 Commercial Ice Machines

### *Current Water Use*

To estimate the current water use from a water-cooled ice machine, identify the following information and use Equation 4-1:

- The ice machine's harvest rate, or how many pounds of ice it produces per day.
- The ice machine's maximum water use rate. EPA's 2005 provides different water use maximums for water-cooled, self-contained units with harvest rates less than 200 pounds per day and those with harvest rates greater than or equal to 200 pounds per day. It also provides different water use maximums for water-cooled, ice-making head units with harvest rates less than 500 pounds per day; those with harvest rates greater than or equal to 500 pounds per day and less than 1,436 pounds per day; and those with harvest rates greater than or equal to 1,436 pounds per day.<sup>19</sup>
- Days of facility operation per year.

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### Equation 4-1. Water Use of Ice Machine (gallons per year)

$$= \text{Harvest Rate} \times \text{Water Use Rate} \times \text{Days of Facility Operation}$$

Where:

- Harvest Rate (pounds of ice per day)
  - Water Use Rate (gallons per 100 pounds of ice)
  - Days of Facility Operation (days per year)
- 

### *Water Use After Replacement*

To estimate the water use of a replacement air-cooled model, use Equation 4-1, substituting the harvest rate (if it will change) and the new water use per hundred pounds of ice. ENERGY STAR provides different water use maximums for qualified air-cooled models depending on the machine type and the harvest rate.<sup>20</sup>

### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing water-cooled ice machine, identify the following information and use Equation 4-2:

- Current water use as calculated using Equation 4-1.
- Water use after replacement as calculated using Equation 4-1.

<sup>19</sup> Energy Policy Act of 2005. Public Law 109-58. August 8, 2005.

<sup>20</sup> EPA and DOE's ENERGY STAR. Commercial Ice Machines Key Product Criteria, *op. cit.*



## 4.2 Commercial Ice Machines

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### Equation 4-2. Water Savings From Ice Machine Replacement (gallons per year)

$$= \text{Current Water Use of Ice Machine} - \text{Water Use of Ice Machine After Replacement}$$

Where:

- Current Water Use of Ice Machine (gallons per year)
  - Water Use of Ice Machine After Replacement (gallons per year)
- 

### *Payback*

To calculate the simple payback from the water savings associated with replacing a water-cooled ice machine, consider the equipment and installation cost of the replacement air-cooled model, the water savings as calculated in Equation 4-2, and the facility-specific cost of water and wastewater.

The facility should also consider the energy impact of replacing old equipment. While air-cooled machines are usually more water-efficient, water-cooled machines are usually more energy-efficient. Some air-cooled units, however, are able to match or exceed the energy efficiency of water-cooled units while also providing substantial water efficiency.<sup>21</sup>

## Additional Resources

Alliance for Water Efficiency (AWE). Commercial Food Service Introduction. [www.allianceforwaterefficiency.org/Commercial\\_Food\\_Service\\_Introduction.aspx](http://www.allianceforwaterefficiency.org/Commercial_Food_Service_Introduction.aspx).

AWE. Ice Machines. [www.allianceforwaterefficiency.org/Ice\\_Machines.aspx](http://www.allianceforwaterefficiency.org/Ice_Machines.aspx).

California Urban Water Conservation Council. Resource Center, Commercial Food Services, Ice-Makers. [www.cuwcc.org/products/commercial-ice-makers.aspx](http://www.cuwcc.org/products/commercial-ice-makers.aspx).

Consortium for Energy Efficiency, Inc. July 1, 2011. High Efficiency Specifications for Commercial Ice Makers. [www.cee1.org/com/com-kit/com-kit-equip.php3](http://www.cee1.org/com/com-kit/com-kit-equip.php3).

DOE, Energy Efficiency & Renewable Energy, Federal Energy Management Program. Covered Product Category: Air-Cooled Ice Makers. [www1.eere.energy.gov/femp/technologies/eep\\_ice\\_makers.html#buying](http://www1.eere.energy.gov/femp/technologies/eep_ice_makers.html#buying).

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD3-5. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

EPA and DOE's ENERGY STAR. Commercial Ice Machines. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=CIM](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CIM).

<sup>21</sup> AWE, *op. cit.*

## 4.2 Commercial Ice Machines

Food Service Technology Center (FSTC) Commercial Foodservice Equipment Lifecycle Cost Calculators. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

FSTC. Ice Machines. [www.fishnick.com/savewater/appliances/icemachines/](http://www.fishnick.com/savewater/appliances/icemachines/).

Koeller, John and Hoffman, H. W. (Bill). Koeller and Company. June 2008. *A Report on Potential Best Management Practices—Commercial Ice Machines*. Prepared for the California Urban Water Conservation Council.

[www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

Pacific Gas and Electric Company. Information Brief: Commercial Ice Machines.

[www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hospitality/icemachinetech.pdf](http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hospitality/icemachinetech.pdf).

## 4.3 Combination Ovens



### Overview

Combination ovens combine three modes of cooking into one oven: steam mode, circulated hot air (i.e., dry heat) mode, or a combination of both (i.e., combi-mode). The steam mode is used for rapid cooking of food items such as vegetables and shellfish. The circulated hot air mode operates in the same manner as a typical convection oven and is traditionally used for roasting meats or baking. The combi-mode is used to reheat, roast, bake, or oven-fry foods. Steam and combi-modes require generation of steam, an energy and water-intensive process.

The amount of water used by a combination oven is primarily dictated by whether it is boiler-based or connectionless (i.e., without a central boiler connection). Typical boiler-based combination ovens are connected to a boiler system that supplies the steam. These systems can waste large amounts of water because they require a continuous stream of water to cool the condensed steam before it is disposed down the drain. They may also supply steam regardless of whether the oven is in operation. In contrast, a connectionless combination oven has a self-contained water reservoir and heat source to create the steam required for the cooking process. This eliminates the use of a separate, central boiler system and saves energy that would have been used to supply continuous steam. Connectionless combination ovens are typically drained and refilled each day and do not require a drain of condensate or the addition of cooling water.

### Operation, Maintenance, and User Education

For optimal combination oven efficiency, consider the following:

- Use the oven's programming capabilities to control the use of the different cooking modes in order to minimize water and energy use, taking into account food preparation requirements. Specifically, where possible, use the steam mode and combi-mode sparingly because these modes consume water and significantly increase energy use. Instead, maximize the use of the circulated hot air mode.
- Turn the oven off or down during slow times or when not in use.
- Keep the oven doors completely closed.
- Whenever possible, maximize the amount of food cooked per use by ensuring that the combination oven is loaded to its full capacity.
- Make sure to replace gaskets when necessary and keep door hinges tight, so that the doors stay aligned and provide a good seal to retain heat or steam.

## 4.3 Combination Ovens

### Retrofit Options

There are currently no known retrofit options available on the market to increase the efficiency of combination ovens.

### Replacement Options

When purchasing a new combination oven or replacing an existing one, look for models that are connectionless and that use no more than 15 gallons of water per hour<sup>22</sup> or 3.5 gallons per pan per hour.<sup>23</sup>

Combination ovens come in varying sizes, depending upon the amount and types of food cooked. Consult the manufacturer to choose a combination oven that is the appropriate size for the cooking needs of the facility. A larger-than-necessary combination oven can waste water and energy to heat unused compartment space.

### Savings Potential

Boiler-based combination ovens can use as much as 30 to 40 gallons of water per hour.<sup>24</sup> Switching to a connectionless combination oven can reduce that water use to 15 gallons of water per hour or less.<sup>25</sup>

The Food Service Technology Center has a life cycle and energy cost calculator, which can be used to calculate the savings potential from replacing many types of commercial kitchen equipment, including combination ovens.<sup>26</sup>

To estimate facility-specific water savings and payback, the facility can also use the following information.

#### *Current Water Use*

To estimate the current water use of an existing combination oven, identify the following information and use Equation 4-3:

- Hourly water use rate in gallons per hour. A typical boiler-based combination oven may use as much as 30 to 40 gallons per hour.
- Average daily use time. This will vary by facility.
- Days of facility operation per year.

<sup>22</sup> East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Page 43. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

<sup>23</sup> Food Service Technology Center (FSTC). Combination Ovens. [www.fishnick.com/savewater/appliances/combinationovens/](http://www.fishnick.com/savewater/appliances/combinationovens/).

<sup>24</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Best Practices—How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities. [www.energystar.gov/index.cfm?c=healthcare.fisher\\_nickel\\_feb\\_2005](http://www.energystar.gov/index.cfm?c=healthcare.fisher_nickel_feb_2005).

<sup>25</sup> *Ibid.*

<sup>26</sup> FSTC. Commercial Foodservice Equipment Lifecycle Cost Calculators. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).



## 4.3 Combination Ovens

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### Equation 4-3. Water Use of Combination Oven (gallons per year)

$$= \text{Water Use Rate of Combination Oven} \times \text{Daily Use Time} \times \text{Days of Facility Operation}$$

Where:

- Water Use Rate of Combination Oven (gallons per hour)
  - Daily Use Time (hours per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Replacement*

To estimate the water use of a replacement combination oven, use Equation 4-3, substituting the replacement combination oven's hourly water use. Connectionless combination ovens can use 15 gallons per hour or less.

#### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing combination oven, identify the following and use Equation 4-4:

- Current water use as calculated using Equation 4-3.
  - Water use after replacement as calculated using Equation 4-3.
- 

### Equation 4-4. Water Savings From Combination Oven Replacement (gallons per year)

$$= \text{Current Water Use of Combination Oven} - \text{Water Use of Combination Oven After Replacement}$$

Where:

- Current Water Use of Combination Oven (gallons per year)
  - Water Use of Combination Oven After Replacement (gallons per year)
- 

#### *Payback*

To calculate the simple payback associated with the water savings from replacing an existing combination oven, consider the equipment and installation cost of the replacement combination oven, the water savings as calculated using Equation 4-4, and the facility-specific cost of water and wastewater. A combination oven can cost approximately \$15,000.<sup>27</sup>

By switching to a connectionless combination oven, facilities also save a significant amount of energy by reducing the water use and steam generation associated with

<sup>27</sup> Harris, Richard. EBMUD. March 5, 2008. "Turning up the Heat on Commercial Kitchen Water Savings." Slide 26. [www.energystar.gov/ia/partners/downloads/meetings/water\\_Richard\\_Harris.pdf](http://www.energystar.gov/ia/partners/downloads/meetings/water_Richard_Harris.pdf).

## 4.3 Combination Ovens

the use of the combination oven. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

### Additional Resources

Alliance for Water Efficiency. Combination Ovens Introduction.

[www.allianceforwaterefficiency.org/1Column.aspx?id=650&terms=combination+ovens](http://www.allianceforwaterefficiency.org/1Column.aspx?id=650&terms=combination+ovens).

East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Page FOOD8. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

EPA and DOE's ENERGY STAR. Best Practices—How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities.

[www.energystar.gov/index.cfm?c=healthcare.fisher\\_nickel\\_feb\\_2005](http://www.energystar.gov/index.cfm?c=healthcare.fisher_nickel_feb_2005).

Food Service Technology Center (FSTC). Combination Ovens.

[www.fishnick.com/savewater/appliances/combinationovens/](http://www.fishnick.com/savewater/appliances/combinationovens/).

FSTC. Commercial Foodservice Equipment Lifecycle Cost Calculators.

[www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

Harris, Richard. EBMUD. March 5, 2008. "Turning up the Heat on Commercial Kitchen Water Savings." [www.energystar.gov/ia/partners/downloads/meetings/water\\_Richard\\_Harris.pdf](http://www.energystar.gov/ia/partners/downloads/meetings/water_Richard_Harris.pdf).

## 4.4 Steam Cookers

### Overview

Steam cookers, also known as food steamers, are commercial kitchen appliances used to prepare foods in a sealed vessel that limits the escape of air or liquids below a preset pressure. There are two types of steam cookers: boiler-based and connectionless (i.e., without a central boiler connection).

Boiler-based steam cookers are connected to a central boiler, which delivers steam to the heating compartment. Steam that does not condense on the food escapes as a mixture of steam and condensate through a drain. In addition, some water is continuously bled off from the steam cooker to help reduce and manage scale buildup. Most manufacturers indicate that water supplied to the steam cooker should be under 50 parts per million (ppm) of total dissolved solids (TDS), or else bleed off should be increased.

Boiler-based steam cookers also use large amounts of water to further condense the steam and to cool (i.e., temper) the condensate water to less than 140°F before it enters the sewer system. Most boiler-based steam cookers offer a standby setting, which maintains the boiler in a ready-to-use state. In many instances, the condensate cooling water will continue to flow even when the steam cooker is in standby mode, particularly if the condensate cooling water is controlled by a valve that must be manually turned on and off. Some boiler-based steam cookers, but not all, do allow for the condensate cooling water to be turned off while the steamer is in standby mode. Steamers that are timer-controlled will automatically switch to standby mode at the end of the set cook time, minimizing the amount of water wasted while the unit is not in use.

Connectionless steam cookers can be either completely unconnected to any water supply or can be connected to a water supply to keep the water reservoir full. Connectionless steam cookers have an individual reservoir where water is heated below the steam trays to create the steam. These types of steam cookers are manually drained and refilled and do not require a dedicated drain for condensate or the addition of cooling or tempering water. A small amount of steam is vented through the top of the steam cooker, but what is not vented or condensed on the food returns as condensate to the reservoir. Connectionless steam cookers that are connected to a water supply have a float valve that maintains the water level in the reservoir, but unlike the boiler-based steam cookers, there is no continuous flow of water. This type of steam cooker is usually as efficient as other connectionless models that are not connected to a water supply.

Steam cookers can achieve lower idle energy rates and reduce the amount of steam needed and water used by reducing the temperature of the compartment during standby mode, not continuously supplying steam to the cooking compartment, and adding insulation. To address these efficiency advances in commercial steam cookers, the U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR® has developed voluntary criteria to qualify energy-efficient—and thus, water-efficient—steam cookers. ENERGY STAR qualified models must meet minimum cooking efficiency and maximum idle energy rate requirements.

## 4.4 Steam Cookers

ENERGY STAR qualified steam cookers typically use at least 90 percent less water when compared to standard steam cooker models. ENERGY STAR qualified steam cookers use an average of 3 gallons of water per hour, while standard models typically use 40 gallons of water per hour.

### Operation, Maintenance, and User Education

For optimal steam cooker efficiency, consider the following:

- Use batch production as opposed to staged loading of food pans (i.e., do not continuously open the door to load and unload food pans).
- In a multi-pan steamer, if possible, fill the steam cooker to capacity instead of cooking one pan at a time.
- Keep the doors closed while the steamer is operating.
- Use only as many steamer compartments as needed.
- Use a timer to ensure that the steam cooker returns to standby mode after use.
- Turn the steam cooker off during long periods of non-use. This will reduce water and energy use associated with keeping the steam cooker in stand-by mode.
- Fix and repair any leaks. Remove any deposit buildup from the boiler on boiler-based models.

### Retrofit Options

There are currently no known retrofit options available on the market to increase the water efficiency of steam cookers.

### Replacement Options

Steam cookers come in several sizes with varying numbers of boiler pans. Be sure to choose a steam cooker that is of the appropriate size for the steam cooking needs of the facility. A larger-than-necessary steam cooker can waste water and energy to heat unused compartment space.

When purchasing a new steam cooker or replacing an existing one, choose models that are ENERGY STAR qualified.<sup>28</sup>

### Savings Potential

ENERGY STAR qualified steam cookers can use 90 percent less water and 50 percent less energy as standard steam cookers.<sup>29</sup> Traditional boiler-based steam cookers use as much as 40 gallons of water per hour. Switching to an ENERGY STAR qualified steam cooker can reduce that water use to 3 gallons of water per hour or less.

<sup>28</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Commercial Steam Cookers. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=COC](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COC).

<sup>29</sup> *Ibid.*



## 4.4 Steam Cookers

Use ENERGY STAR's commercial kitchen equipment savings calculator<sup>30</sup> to estimate facility-specific water, energy, and cost savings for replacing an existing boiler-based steam cooker with an ENERGY STAR qualified model.

The Food Service Technology Center also has a life cycle and energy cost calculator, which can be used to calculate the savings potential from replacing many types of commercial kitchen equipment, including steam cookers.<sup>31</sup>

To estimate facility-specific water savings and payback, the facility can also use the following information.

### *Current Water Use*

To estimate the water use of a steam cooker, identify the following information and use Equation 4-5:

- Water use rate of the existing steam cooker, typically provided in gallons per hour.
- Average daily use time.
- Days of facility operation per year.

---

### Equation 4-5. Water Use of Steam Cooker (gallons per year)

$$= \text{Steam Cooker Water Use Rate} \times \text{Daily Use Time} \times \text{Days of Operation}$$

Where:

- Steam Cooker Water Use Rate (gallons per hour)
  - Daily Use Time (hours per day)
  - Days of Operation (days per year)
- 

### *Water Use After Replacement*

To estimate the water use after replacing an existing steam cooker with an ENERGY STAR qualified steam cooker, use Equation 4-5, substituting the water use of the ENERGY STAR qualified steam cooker for the water use of the existing steam cooker.

### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing steam cooker, identify the following information and use Equation 4-6:

- Current water use as calculated using Equation 4-5.
- Water use after replacement as calculated using Equation 4-5.

<sup>30</sup> EPA and DOE's ENERGY STAR. Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment. [www.energystar.gov/ia/business/bulk\\_purchasing/bpsavings\\_calc/commercial\\_kitchen\\_equipment\\_calculator.xls](http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls).

<sup>31</sup> Food Service Technology Center. Commercial Foodservice Equipment Lifecycle Cost Calculator. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

## 4.4 Steam Cookers

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### Equation 4-6. Water Savings From Steam Cooker Replacement (gallons per year)

$$= \text{Current Water Use of Steam Cooker} - \text{Water Use of Steam Cooker After Replacement}$$

Where:

- Current Water Use of Steam Cooker (gallons per year)
  - Water Use of Steam Cooker After Replacement (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with replacing an existing steam cooker, consider the equipment and installation cost of the ENERGY STAR qualified steam cooker, the water savings as calculated in Equation 4-6, and the facility-specific cost of water and wastewater.

By switching to an ENERGY STAR qualified steam cooker, facilities can also save a significant amount of energy. ENERGY STAR qualified steam cookers can use half as much energy as standard steam cookers.<sup>32</sup> This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

### Additional Resources

Alliance for Water Efficiency. Food Steamers Introduction.

[www.allianceforwaterefficiency.org/1Column.aspx?id=642&terms=steam](http://www.allianceforwaterefficiency.org/1Column.aspx?id=642&terms=steam).

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD7-8. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

EPA and DOE's ENERGY STAR. Commercial Steam Cookers. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=COC#buying](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COC#buying).

Food Service Technology Center (FSTC). Commercial Foodservice Equipment Life-cycle Cost Calculators. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

FSTC. Steamers. [www.fishnick.com/savewater/appliances/steamers/](http://www.fishnick.com/savewater/appliances/steamers/).

<sup>32</sup> EPA and DOE's ENERGY STAR. Commercial Steam Cookers, *op. cit.*

## 4.5 Steam Kettles

### Overview

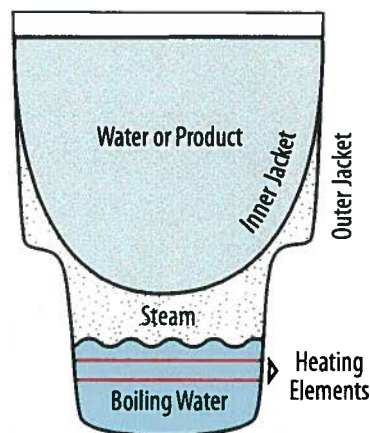
Steam kettles are boiler-based or self-contained cooking appliances that use circulating steam to perform tasks similar to traditional stockpots, including boiling pasta and simmering sauces. Steam kettles may be preferable to traditional stockpots due to their rapid, uniform cooking and ease of control.

Steam kettles have a double wall that covers at least half of the height of the sides of the kettle. Steam is circulated within this double wall, or “jacket,” then condenses to transfer heat to the food product by means of conduction. Steam kettles range in capacity from 0.5 gallon to more than 200 gallons each.<sup>33</sup> Steam kettles can also be designed with tilting capability, strainers, and covers.

Boiler-based steam kettles rely on an external central boiler to deliver steam. These types of steam kettles are commonly found in large facilities with centrally located boilers. Boiler-based steam kettles require a regular blowdown to remove condensate on the steam supply line and can consume more than 100,000 gallons of water per year. Returning condensate to the boiler as make-up water can reduce this water consumption.<sup>34</sup>

Self-contained steam kettles rely on their own heat source to generate steam under pressure (see Figure 4-2). Self-contained steam kettles use less water and energy than boiler-based steam kettles because they do not require significant blowdown water. Boiler water must be dumped at the end of the day to prevent mineral buildup. They also require de-liming on a regular basis and regular manual venting and refilling.<sup>35</sup>

Figure 4-2. Self-Contained Steam Kettle



<sup>33</sup> The Northeast Center for Food Entrepreneurship at the New York State Food Venture Center, Cornell University. January 2007. *Steam Kettles in Food Processing: Fact Sheets for the Small Scale Food Entrepreneur*. [necfe.foodscience.cornell.edu/publications/fact-sheets.php](http://necfe.foodscience.cornell.edu/publications/fact-sheets.php).

<sup>34</sup> East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Page FOOD6. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

<sup>35</sup> The Northeast Center for Food Entrepreneurship at the New York State Food Venture Center, Cornell University, *op. cit.*

## 4.5 Steam Kettles

### Operation, Maintenance, and User Education

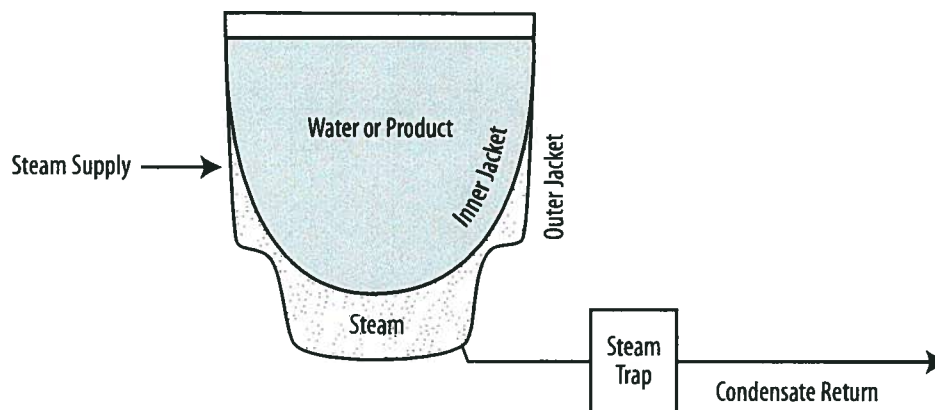
For optimal steam kettle efficiency, consider the following:

- Regularly monitor self-contained steam kettle water levels and maintain temperature control components to ensure efficient operation.
- Turn the steam kettle down or off between uses.
- Make sure the steam kettle lid is secured whenever possible to reduce the amount of energy required for simmering and boiling.

### Retrofit Options

Since the steam does not come into contact with the food, if a boiler-based steam kettle is used, a condensate return system can be installed to direct the condensate back into the central boiler system for reuse (see Figure 4-3). This process will improve both water and energy efficiency because the condensate can be used as boiler make-up water. Facilities can purchase packaged condensate return systems from most steam equipment suppliers and plumb them directly into an existing system. Insulating condensate return lines will further improve their efficiency.

Figure 4-3. Boiler-Type Steam Kettle



### Replacement Options

When purchasing a new steam kettle or replacing an old one, consider the kettle cooking needs of the kitchen. For smaller needs, consider a self-contained steam kettle without an external boiler, which uses less water and energy than boiler-based steam kettles. If daily operations require a boiler-based steam kettle, consider a model with a condensate return system. Be sure to choose a steam kettle with a properly sized steam trap, to prevent inadvertent dumping of condensate.



### Savings Potential

Retrofitting or replacing existing steam kettles can yield significant water savings. For a boiler-based steam kettle, the water savings achieved by returning the condensate to the boiler can be substantial. Actual water savings are difficult to approximate because the water use of a steam kettle varies based on its size and the pressure of the steam.

To estimate facility-specific water savings and payback, use the following information.

#### *Current Water Use*

To estimate the water use of a steam kettle, identify the following information and use Equation 4-7:

- Water use per day of the existing steam kettle. The equipment manufacturer or vendor should be able to help determine the daily water use.
- Days of facility operation per year.

---

#### Equation 4-7. Water Use of Steam Kettle (gallons per year)

$$= \text{Water Use of Steam Kettle} \times \text{Days of Facility Operation}$$

Where:

- Water Use of Steam Kettle (gallons per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Retrofit or Replacement*

To estimate the water use after retrofitting or replacing an existing steam kettle, use Equation 4-7, substituting water use of the new configuration or new system for the water use of the existing steam kettle.

#### *Water Savings*

To calculate the water savings that can be achieved from retrofitting or replacing an existing steam kettle, identify the following information and use Equation 4-8:

- Current water use as calculated using Equation 4-7.
- Water use after retrofit or replacement as calculated using Equation 4-7.

## 4.5 Steam Kettles

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**Equation 4-8. Water Savings From Steam Kettle Retrofit or Replacement (gallons per year)**

**= Current Water Use of Steam Kettle – Water Use of Steam Kettle After Retrofit or Replacement**

Where:

- Current Water Use of Steam Kettle (gallons per year)
  - Water Use of Steam Kettle After Retrofit or Replacement (gallons per year)
- 

### *Payback*

To calculate the simple payback associated with the water savings from retrofitting or replacing an existing steam kettle, consider the equipment and installation cost of the retrofit or replacement, the water savings as calculated in Equation 4-8, and the facility-specific cost of water and wastewater.

By switching to a self-contained steam kettle or by returning condensate back to the boiler in a boiler-based system, facilities can also save a significant amount of energy. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

## **Additional Resources**

DOE, Energy Efficiency & Renewable Energy, Federal Energy Management Program. Best Management Practice: Commercial Kitchen Equipment. [www1.eere.energy.gov/femp/program/waterefficiency\\_bmp11.html](http://www1.eere.energy.gov/femp/program/waterefficiency_bmp11.html).

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD5-6. [www.ebmud.com/customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

Food Service Technology Center. Steam Kettles. [www.fishnick.com/equipment/appliancetypes/steamkettles](http://www.fishnick.com/equipment/appliancetypes/steamkettles).

The Northeast Center for Food Entrepreneurship at the New York State Food Venture Center, Cornell University. January 2007. *Steam Kettles in Food Processing: Fact Sheets for the Small Scale Food Entrepreneur*. [necfe.foodscience.cornell.edu/publications/fact-sheets.php](http://necfe.foodscience.cornell.edu/publications/fact-sheets.php).

Robert M. Kerr Food & Agricultural Products Center. *Food Technology Fact Sheet: Steam Kettle Hookup*. [www.fapc.okstate.edu/files/factsheets/fapc120.pdf](http://www.fapc.okstate.edu/files/factsheets/fapc120.pdf).

## 4.6 Wok Stoves

### Overview

A wok stove is a Chinese pit-style stove that has a wok, or multiple woks, recessed into the stove top, allowing heat to be fully directed onto the bottom of the wok. Wok stoves can use water for cooling, cleaning, and cooking.<sup>36</sup>

### Cooling

In a conventional water-cooled wok stove, the burner chimney and ring are affixed to the top of the stove, trapping heat under the cooktop. To absorb the heat and keep the cooktop cool, water jets spray cooling water across the cooktop at a rate of approximately 1.0 gallon per minute (gpm) per burner.

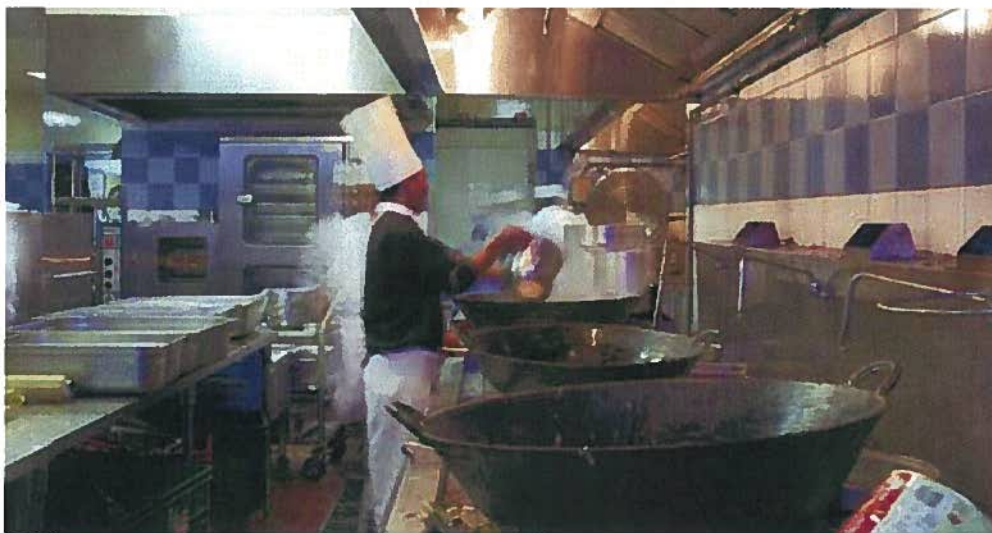
### Cleaning

Wok stoves can be outfitted with a rinsing spout used to rinse and clean the wok between uses. In many cases, the rinsing spout might be left running continuously, even when not in use, because the operator may not have time to turn it off.

### Cooking

Many wok stoves also have a separate reservoir tap that fills a small reservoir used for cooking. As with rinsing spouts, the reservoir tap might be left running continuously even when the reservoir is full.

An illustration of a conventional water-cooled wok stove is shown in Figure 4-4.

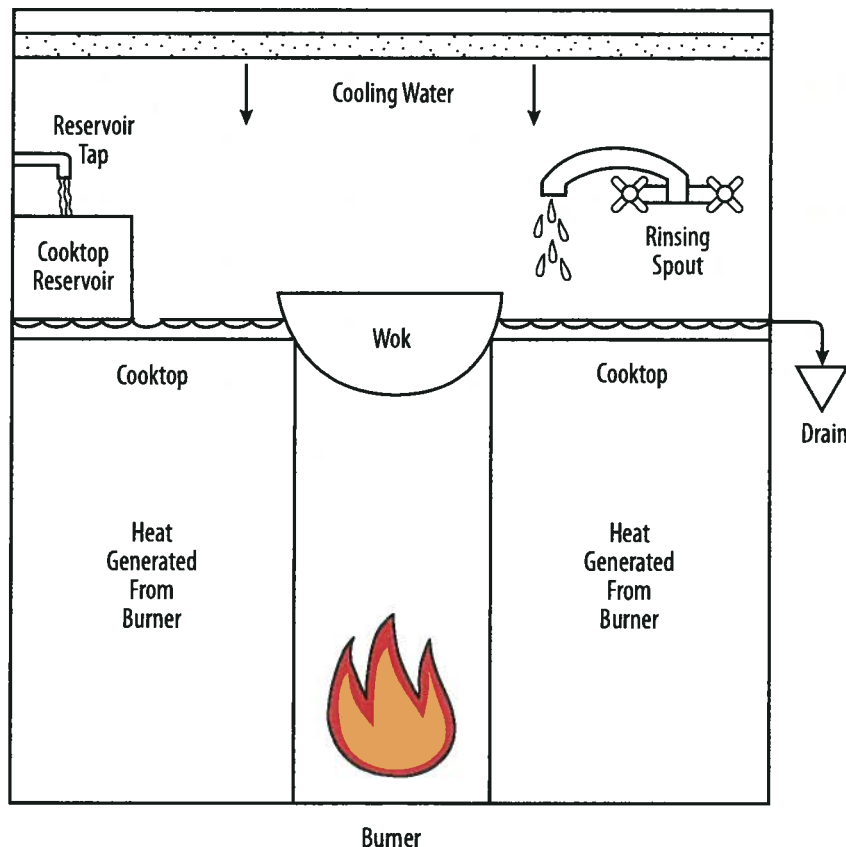


Wok stoves

<sup>36</sup> Sydney Water. Wok stoves: The waterless wok stove. [www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm](http://www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm).

## 4.6 Wok Stoves

Figure 4-4. Water-Cooled Wok Stove



Waterless wok stoves, a relatively new technology, are cooled with air, and thus do not require the use of cooling water. One such type of wok stove functions by creating an air gap between the burner chimney and ring and the top of the stove, so that the heat can be released directly from beneath the cooktop and vented to the kitchen exhaust (see Figure 4-5). This eliminates the need for cooling water entirely. Waterless wok stoves can further reduce water use if they are outfitted with a rinsing spout that shuts off the water supply when it is not needed for wok cleaning. In addition, waterless wok stoves may have a mechanism such as a knee-operated timer reservoir tap that limits both the flow rate and duration of flow of the reservoir tap.<sup>37</sup>

Another new wok stove technology connects to a built-in recirculation loop originating from under the wok stove cooktop to recirculate cooling water via an external point-of-use chiller. This type of wok stove has an internal backup water-using system in the event that the recirculated chilled water is not available. A study of this type of wok stove conducted by the Food Service Technology Center showed negligible energy use associated with the use of the external chiller.<sup>38</sup>

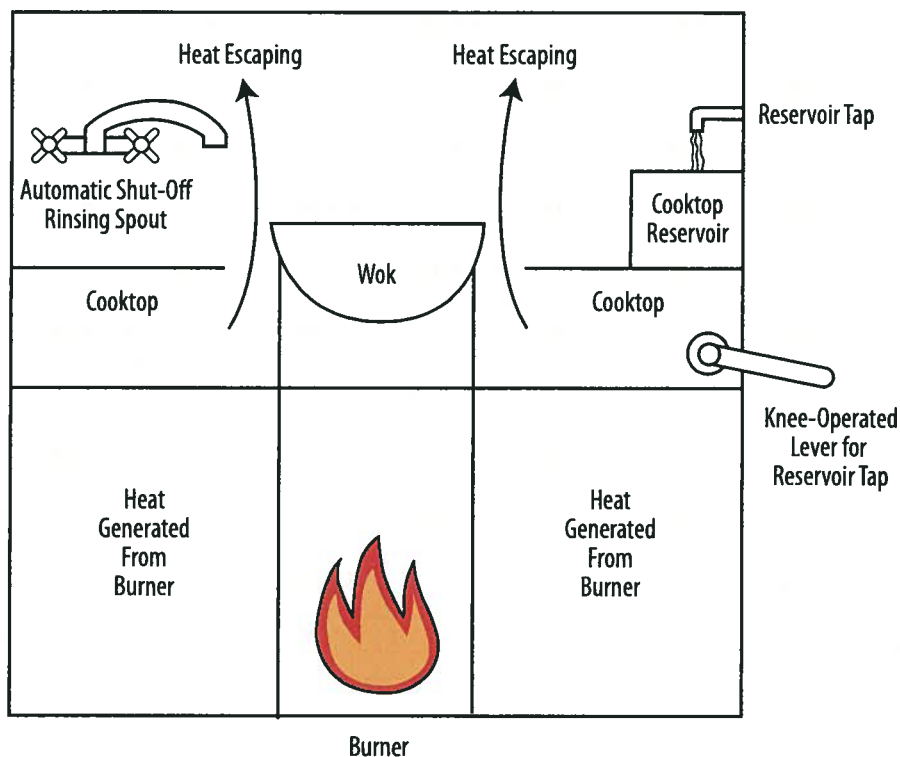
<sup>37</sup> Alliance for Water Efficiency. Waterless Wok Introduction. [www.allianceforwaterefficiency.org/1Column.aspx?id=700](http://www.allianceforwaterefficiency.org/1Column.aspx?id=700).

<sup>38</sup> Sham, Kong and Zabrowski, David. Food Service Technology Center. March 2010. *Wok Water Saver Performance Test*. Prepared for Pacific Gas & Electric Company. [www.fishnick.com/publications/appliancereports/rangetops/Wok\\_Water\\_Saver.pdf](http://www.fishnick.com/publications/appliancereports/rangetops/Wok_Water_Saver.pdf).



## 4.6 Wok Stoves

Figure 4-5. One Type of Air-Cooled Wok Stove



By replacing conventional wok stoves with waterless or recirculating chilled water models and reducing the flow rate and duration of rinse spouts and reservoir taps, facilities could use 90 percent less water than normally required for cooling, cleaning, and cooking in wok stoves.<sup>39</sup>

### Operation, Maintenance, and User Education

For optimal wok stove efficiency, consider the following:

- Encourage cooking staff to turn off rinse spouts and reservoir taps when not in use.
- Inspect and ensure the shut-off valves for the rinse spouts and reservoir taps are in working order.
- Ensure the cooling water is shut off when the wok stove is not in use, especially at the end of each day.
- Routinely check cooling water lines for leaks and corrosion.

<sup>39</sup> Sydney Water, *op. cit.*

## 4.6 Wok Stoves

### Retrofit Options

If retrofitting an existing conventional wok stove, check to see if rinse spouts can be replaced with spouts that automatically shut off or that can switch off when pushed back away from the wok.

### Replacement Options

When purchasing a new wok stove or replacing an existing conventional wok stove, look for models that are considered waterless, or are air-cooled instead of water-cooled. Waterless wok stoves can use about 2 percent more energy than a conventional wok stove,<sup>40</sup> but they can use 90 percent less water. Alternatively, look for models that use recirculated chilled water. Also, consider models that have automatic shut-off rinse spouts and/or knee-operated timer reservoir taps to limit both the flow rate and duration of the flow to the rinse spout and reservoir tap.

### Savings Potential

Water savings can be achieved through two mechanisms: eliminating the use of cooling water and reducing the flow rate and duration of use of rinse spouts and reservoir tap.

To calculate facility-specific water savings and payback, use the following information.

#### Wok Stove Retrofit

Wok cleaning and cooking activities can use 500 to 800 gallons of water per day, particularly if the rinse spouts and reservoir taps are left constantly running. Retrofitting the wok stove to reduce the flow rate and duration of use of rinse spouts and reservoir taps can significantly reduce water use associated with wok cleaning and cooking.

#### Current Water Use

To estimate the current water use of the existing wok stove rinse and reservoir spouts, identify the following information and use Equation 4-9:

- Flow rate of each rinse and reservoir spout.
- Average daily use time of rinse and reservoir spouts.
- Number of days the facility operates each year.

<sup>40</sup> International Association of Plumbing and Mechanical Officials (IAPMO). 2010. "2010's Top-5 New and Innovative Water Efficient Products." *Green Newsletter*. [forms.iapmo.org/newsletter/green/2010/05/2010\\_Top5.asp](http://forms.iapmo.org/newsletter/green/2010/05/2010_Top5.asp).

## 4.6 Wok Stoves

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### Equation 4-9. Water Use of Wok Stove Rinse and Reservoir Spouts (gallons per year)

$$= \text{Flow Rate of Rinse or Reservoir Spout} \times \text{Daily Use Time} \times \text{Days of Facility Operation}$$

Where:

- Flow Rate of Rinse or Reservoir Spout (gallons per minute)
  - Daily Use Time (minutes per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Retrofit*

To estimate the water use of more efficient rinse and reservoir spouts, use Equation 4-9, substituting the flow rate and use time of the retrofit rinse and reservoir spouts.

#### *Water Savings*

To calculate the water savings from the retrofit of an existing wok stove with more efficient rinse and reservoir spouts, identify the following information and use Equation 4-10:

- Current water use as calculated using Equation 4-9.
  - Water use after retrofit using Equation 4-9.
- 

### Equation 4-10. Water Savings From Wok Stove Rinse and Reservoir Spout Retrofit (gallons per year)

$$= \text{Current Water Use of Wok Stove Rinse and Reservoir Spouts} - \text{Water Use of Wok Stove After Retrofit of Rinse and Reservoir Spouts}$$

Where:

- Current Water Use of Wok Stove Rinse and Reservoir Spouts (gallons per year)
  - Water Use of Wok Stove After Retrofit of Rinse and Reservoir Spouts (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with retrofitting an existing wok stove with more efficient rinse and reservoir spouts, consider the equipment and installation cost of the retrofit rinse and reservoir spouts, the water savings as calculated using Equation 4-10, and the facility-specific cost of water and wastewater.

## 4.6 Wok Stoves

### Wok Stove Replacement

During the course of a 12-hour day, a conventional water-cooled wok stove can use more than 700 gallons of water. Switching to a waterless wok or one that uses recirculated chilled water can eliminate this use of single-pass cooling water. To estimate facility-specific water savings and payback, use the following information.

#### *Water Use and Savings*

To estimate the water used for cooling of a conventional wok stove and subsequent water savings associated with a waterless wok stove or one that uses recirculated chilled water, identify the following information and use Equation 4-11:

- Flow rate of the cooling water. This flow rate is typically 1.0 gpm.
- Average daily use time.
- Days of facility operation per year.

---

**Equation 4-11. Water Use and Savings From Water-Cooled Wok Stove Replacement (gallons per year)**

**= Current Wok Stove Cooling Water Flow Rate x Daily Use Time x Days of Facility Operation**

Where:

- Current Wok Stove Cooling Water Flow Rate (gallons per minute)
  - Daily Use Time (minutes per day)
  - Days of Facility Operation (days per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with replacing an existing conventional wok stove, consider the equipment and installation cost of the replacement waterless wok stove or one that uses recirculated chilled water, the water savings as calculated using Equation 4-11, and the facility-specific cost of water and wastewater.

The facility should also consider the energy impact of replacing old equipment. Waterless wok stoves can use about 2 percent more energy than a conventional wok stove,<sup>41</sup> but they use at least 90 percent less water.

### Additional Resources

Alliance for Water Efficiency. Waterless Wok Introduction.  
[www.allianceforwaterefficiency.org/1Column.aspx?id=700](http://www.allianceforwaterefficiency.org/1Column.aspx?id=700).

City West Water Limited. Programs and Assistance, Working the Way to Water Savings.  
[www.citywestwater.com.au/business/programs\\_and\\_assistance\\_working\\_the\\_way\\_to\\_water\\_savings.aspx](http://www.citywestwater.com.au/business/programs_and_assistance_working_the_way_to_water_savings.aspx).

<sup>41</sup> IAPMO, *op. cit.*

## 4.6 Wok Stoves

International Association of Plumbing and Mechanical Officials. 2010.  
"2010's Top-5 New and Innovative Water Efficient Products." *Green Newsletter*.  
[forms.iapmo.org/newsletter/green/2010/05/2010\\_Top5.asp](http://forms.iapmo.org/newsletter/green/2010/05/2010_Top5.asp).

Sydney Water. Wok stoves: The waterless wok stove.  
[www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm](http://www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm).

## 4.7 Dipper Wells



### Overview

Dipper wells are used in some restaurants, coffee houses, and ice cream shops to rinse utensils between uses. Most dipper wells have a single spigot and a valve that controls the flow of either hot or cold water into a receiving well. Shops often have dipper wells running constantly during service hours to provide a continuous exchange of the water in the well, in order to reduce the potential for bacterial growth.

Dipper wells have flow rates between 0.5 and 1.0 gallon per minute (gpm).<sup>42</sup>

Food service locations should ensure that the requirements of the U.S. Department of Health and Human Services Food Code<sup>43</sup> are met when considering changes to facility operations that may involve installing, retrofitting, or replacing a dipper well.

### Operation, Maintenance, and User Education

For optimal dipper well efficiency, consider the following:

- Turn off water when service periods are slow and the dipper well is not in use. Also, turn off the water to the dipper well at the end of each day. Be sure to clean the dipper well prior to restarting the water in order to remove any bacterial buildup.
- Keep the flow rate of the dipper well valve at its minimum level. Some municipalities recommend no more than 0.3 gpm.<sup>44</sup>
- Consider rinsing utensils with a sink faucet only as needed, rather than using the dipper well.

### Retrofit Options

To reduce the water use associated with a dipper well, consider installing an in-line flow restrictor to reduce the flow rate from 0.5 or 1.0 gpm to 0.3 gpm.

### Replacement Options

When looking to replace dipper wells, consider these options:

- Install a push-button, metered faucet for utensil rinsing.
- If the facility has enough utensils to run full dishwasher loads, consider installing an ENERGY STAR® qualified, commercial undercounter dishwasher<sup>45</sup> to replace the dipper well to wash utensils after use. These commercial dishwashers can use less than 1.0 gallon per rack.

<sup>42</sup> East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD8-9. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

<sup>43</sup> U.S. Food and Drug Administration (FDA). FDA Food Code 2009: Chapter 3—Food. Sections 3-304.11 and 3-304.12. [www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/ucm186451.htm](http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/ucm186451.htm).

<sup>44</sup> Arizona Department of Water Resources. *Implementing a Water Management Plan Checklist for Facility Managers*. Page 8. [www.azwater.gov/azdwr/StatewidePlanning/Conservation2/CommercialIndustrial/FacilityManagers.htm](http://www.azwater.gov/azdwr/StatewidePlanning/Conservation2/CommercialIndustrial/FacilityManagers.htm).

<sup>45</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Commercial Dishwashers. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=COH](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COH).



## 4.7 Dipper Wells

### Savings Potential

Water savings can be achieved in two ways: by retrofitting the dipper well to reduce the flow rate or by replacing a dipper well with a metered faucet or an ENERGY STAR qualified commercial undercounter dishwasher.

#### Dipper Well Retrofit With In-Line Flow Restrictor

Retrofitting a dipper well with an in-low flow restrictor can be a simple way to save water.

##### *Current Water Use*

To estimate the water use of an existing dipper well, identify the following information and use Equation 4-12:

- Flow rate of the existing dipper well. Most dipper wells have flow rates between 0.5 and 1.0 gpm.<sup>46</sup>
- Average daily use time.
- Days of facility operation per year.

---

#### Equation 4-12. Water Use of Dipper Well (gallons per year)

$$= \text{Dipper Well Flow Rate} \times \text{Daily Use Time} \times \text{Days of Facility Operation}$$

Where:

- Dipper Well Flow Rate (gallons per minute)
- Daily Use Time (minutes per day)
- Days of Facility Operation (days per year)

---

##### *Water Use After Retrofit*

To estimate the water use after retrofitting an existing dipper well with an in-line flow restrictor, use Equation 4-12, substituting the flow rate of the retrofit in-line flow restrictor for the flow rate of the existing dipper well. An efficient, retrofit in-line flow restrictor should provide a maximum flow rate of 0.3 gpm.

##### *Water Savings*

To calculate the water savings that can be achieved from retrofitting an existing dipper well, identify the following information and use Equation 4-13:

- Current water use as calculated using Equation 4-12.
- Water use after retrofit as calculated using Equation 4-12.

<sup>46</sup> EBMUD, *op. cit.*

## 4.7 Dipper Wells

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### Equation 4-13. Water Savings From Dipper Well Retrofit or Replacement (gallons per year)

$$= \text{Current Water Use of Dipper Well} - \text{Water Use After Retrofit or Replacement}$$

Where:

- Current Water Use of Dipper Well (gallons per year)
  - Water Use After Retrofit or Replacement (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with retrofitting an existing dipper well, consider the equipment and installation cost of the retrofit in-line flow restrictor, the water savings as calculated in Equation 4-13, and the facility-specific cost of water and wastewater.

After retrofitting an existing dipper well with an in-line flow restrictor, facilities can save energy from the reduced hot water use. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

#### **Dipper Well Replacement With Push-Button, Metered Faucet**

Although installing a dipper well retrofit is likely the most cost-effective choice for a facility, significant water savings can also be achieved by replacing a dipper well with a push-button, metered faucet.

#### *Current Water Use*

To estimate the current water use of an existing dipper well, use Equation 4-12.

#### *Water Use After Replacement With Metered Faucet*

To estimate the water use after replacing an existing dipper well with a push-button, metered faucet, identify the following information and use Equation 4-14:

- Flow rate of the push-button, metered faucet (in gallons per cycle).
- Average cycles used per hour.
- Average daily use time.
- Days of facility operation per year.

## 4.7 Dipper Wells

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### Equation 4-14. Water Use of Push-Button, Metered Faucet (gallons per year)

$$= \text{Flow Rate of Push-Button, Metered Faucet} \times \text{Uses per Hour} \times \text{Daily Use Time} \times \text{Days of Facility Operation}$$

Where:

- Flow Rate of Push-Button, Metered Faucet (gallons per cycle)
  - Uses per Hour (cycles per hour)
  - Daily Use Time (hours per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing dipper well with a push-button, metered faucet, identify the following information and use Equation 4-13:

- Current water use as calculated using Equation 4-12.
- Water use after replacement as calculated using Equation 4-14.

#### *Payback*

To calculate the simple payback from the water savings associated with replacing an existing dipper well with a push-button, metered faucet, consider the equipment and installation cost of installing the new push-button, metered faucet; the water savings as calculated in Equation 4-13; and the facility-specific cost of water and wastewater.

After replacing an existing dipper well with a push-button, metered faucet, facilities may save energy from the reduced hot water use. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

#### **Dipper Well Replacement With an ENERGY STAR Qualified Dishwasher**

Although installing a dipper well retrofit is likely the most cost-effective choice for a facility, significant water savings can also be achieved by replacing a dipper well with an ENERGY STAR qualified commercial undercounter dishwasher.

#### *Current Water Use*

To estimate the current water use of an existing dipper well, use Equation 4-12.

## 4.7 Dipper Wells

### *Water Use After Replacement With an ENERGY STAR Qualified Dishwasher*

To estimate the water use after replacing an existing dipper well with an ENERGY STAR qualified commercial undercounter dishwasher, identify the following information and use Equation 4-15:

- Water use per rack washed. A high-temperature, ENERGY STAR qualified commercial undercounter dishwasher uses 1.0 gallons per rack or less. A low-temperature model uses 1.7 gallons per rack or less.<sup>47</sup>
- Average estimate of racks washed per day.
- Days of facility operation per year.

---

#### Equation 4-15. Water Use of an ENERGY STAR Qualified Commercial, Undercounter Dishwasher (gallons per year)

$$= \text{Water Use per Rack} \times \text{Racks Washed per Day} \times \text{Days of Facility Operation}$$

Where:

- Water Use per Rack (gallons per rack)
  - Racks Washed per Day (racks per day)
  - Days of Facility Operation (days per year)
- 

### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing dipper well with an ENERGY STAR qualified commercial undercounter dishwasher, identify the following information and use Equation 4-13:

- Current water use as calculated using Equation 4-12.
- Water use after replacement as calculated using Equation 4-15.

### *Payback*

To calculate the simple payback from the water savings associated with replacing an existing dipper well with an ENERGY STAR qualified commercial undercounter dishwasher, consider the equipment and installation cost of the new dishwasher, the water savings as calculated in Equation 4-13, and the facility-specific cost of water and wastewater. Installing a new ENERGY STAR qualified commercial undercounter dishwasher can cost approximately \$6,000.<sup>48</sup>

The facility should also consider the energy impact of replacing the dipper well with an ENERGY STAR qualified dishwasher. The dishwasher might use less hot water than the dipper well, but it also uses energy to run cleaning cycles.

<sup>47</sup> EPA and DOE's ENERGY STAR. Commercial Dishwashers Key Product Criteria. [www.energystar.gov/index.cfm?c=comm\\_dishwashers.pr\\_crit\\_comm\\_dishwashers](http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers).

<sup>48</sup> EPA and DOE's ENERGY STAR. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Commercial Dishwasher(s). [www.energystar.gov/ia/business/bulk\\_purchasing/bpsavings\\_calc/CalculatorCommercialDishwasher.xls](http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorCommercialDishwasher.xls).

### Additional Resources

Arizona Department of Water Resources. *Implementing a Water Management Plan Checklist for Facility Managers*. Page 8. [www.azwater.gov/azdwr/StatewidePlanning/Conservation2/CommercialIndustrial/FacilityManagers.htm](http://www.azwater.gov/azdwr/StatewidePlanning/Conservation2/CommercialIndustrial/FacilityManagers.htm).

Brean, Henry. June 8, 2009. "UNLV professor targets 'wasteful' dipper wells." *Las Vegas Review-Journal*. [www.lvrj.com/news/47195482.html](http://www.lvrj.com/news/47195482.html).

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD8-9. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

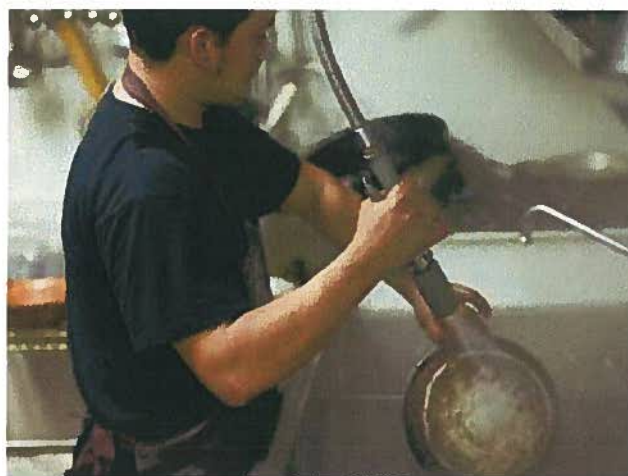
EPA and DOE's ENERGY STAR. Best Practices—How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities. [www.energystar.gov/index.cfm?c=healthcare.fisher\\_nickel\\_feb\\_2005](http://www.energystar.gov/index.cfm?c=healthcare.fisher_nickel_feb_2005).

EPA and DOE's ENERGY STAR. Commercial Dishwashers Key Product Criteria. [www.energystar.gov/index.cfm?c=comm\\_dishwashers.pr\\_crit\\_comm\\_dishwashers](http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers).

## 4.8 Pre-Rinse Spray Valves

### Overview

Commercial pre-rinse spray valves are spray nozzles that use water under pressure to remove food residue from plates, pots, pans, and other kitchen utensils prior to sanitation in a dishwasher. Pre-rinse spray valves designed for commercial dishwashing are different from spray valves used for filling glasses, pots, or kettles and for washing down countertops, floors, and other kitchen areas, all of which typically have very different usage patterns and higher flow rates. These other types of spray valves are not the focus of this section. Sink faucets for commercial kitchen use are covered under *Section 3.4: Faucets*.



*Pre-rinse spray valve*

Pre-rinse spray valves designed for commercial dishwashing are connected to a hose, which is connected to the water supply. These handheld devices consist of a spray nozzle, a squeeze lever that controls the water flow, and a dish guard bumper. They often include a spray handle clip, allowing the user to lock the lever at full spray for continual use, which can reduce hand irritation. They can be installed at the end of a flexible stainless steel hose and can include a foot-operated, on-off lever. Pre-rinse spray valves are usually located at the entrance to a dishwasher or over a sink and are used in conjunction with a faucet fixture.

The Energy Policy Act (EPAct) of 2005 established the maximum allowable flow rate for all commercial pre-rinse spray valves sold in the United States at 1.6 gallons per minute (gpm). Older models can use between 3.0 and 4.5 gpm. Since EPAct 2005 established maximum flow rate requirements, more efficient products have been developed with flow rates as low as 0.65 gpm.

The U.S. Environmental Protection Agency's (EPA's) WaterSense® program is considering a label for high-efficiency pre-rinse spray valves, with plans to set a water-efficiency level at least 20 percent below the federal standard and address product performance. Replacing a pre-rinse spray valve that flows at 1.6 gpm or higher with one that is at least 20 percent more water-efficient will result in significant water and energy savings and a simple payback period of less than one year for most facilities.

### Operation, Maintenance, and User Education

For optimal pre-rinse spray valve efficiency, system pressure should be tested to ensure that it is between 20 and 80 pounds per square inch (psi). This will ensure that the pre-rinse spray valve will deliver the expected flow and performance. In addition, consider the following:



## 4.8 Pre-Rinse Spray Valves

- Ensure that the pre-rinse spray valve unit's hose height is appropriate for the user (i.e., neither too high nor too low). If the pre-rinse spray valve is not situated at an optimal height, users could choose to use other kitchen sprayers, which may have higher flow rates.
- To decrease water use, train users to manually scrape as much food waste from dishes as possible before using the pre-rinse spray valve.
- If possible, pre-soak heavily soiled dishes in a basin of water to loosen food residue.
- Train users how to properly use the always-on clamp, if available. Improper use of the always-on clamp could lead to unnecessary water waste. If a constant stream of water is not necessary, train users to manually depress the pre-rinse spray valve handle only when water is needed.
- Periodically inspect pre-rinse spray valves for scale buildup to ensure flow is not being restricted. There are certain cleaning products designed to dissolve scale buildup from pre-rinse spray valves. Do not attempt to bore holes in the pre-rinse spray valve, as this may lead to increased water use or cause performance problems. If scale cannot be removed, consider replacing the pre-rinse spray valve with a new model.
- Periodically inspect pre-rinse spray valves for leaks and broken or loose parts. If necessary and possible, tighten screws and fittings to stop leakage. If the product cannot be manually adjusted to perform properly, consider replacing the pre-rinse spray valve.
- Conduct routine inspections for leaks and train appropriate custodial and cleaning personnel and users to identify and report leaks.



*User manually depressing pre-rinse spray valve handle during use*

### Retrofit Options

Because pre-rinse spray valves are relatively inexpensive, consider replacement rather than a retrofit or extensive repair. In general, avoid retrofitting existing, inefficient pre-rinse spray valves with flow control inserts (which restrict water flow) to reduce the flow rate. These devices might not provide adequate performance in some facilities, thereby increasing use time and total water used.

### Replacement Options

When installing new pre-rinse spray valves or replacing older, inefficient pre-rinse spray valves, choose models with flow rates of 1.3 gpm or less.

## 4.8 Pre-Rinse Spray Valves

### Savings Potential

Water savings can be achieved by replacing existing pre-rinse spray valves. Because water use of pre-rinse spray valves is dependent on facility operations and factors such as average throughput, water savings will vary by facility. To estimate facility-specific water savings and payback, use the following information.

#### *Current Water Use*

To estimate the current water use of a pre-rinse spray valve, identify the following information and use Equation 4-16:

- Flow rate of the existing pre-rinse spray valve. Pre-rinse spray valves installed after 2005 have flow rates of 1.6 gpm or less. Pre-rinse spray valves installed before 2005 can have flow rates of up to 4.5 gpm.
- Average daily use time. This will vary by facility, but facilities typically use pre-rinse spray valves for no more than 200 minutes per day.<sup>49</sup>
- Days of facility operation per year.

---

#### Equation 4-16. Water Use of Pre-Rinse Spray Valve (gallons per year)

**= Flow Rate of Pre-Rinse Spray Valve x Daily Use Time x Days of Facility Operation**

Where:

- Flow Rate of Pre-Rinse Spray Valve (gallons per minute)
  - Daily Use Time (minutes per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Replacement*

To estimate the water use of a more efficient replacement pre-rinse spray valve, use Equation 4-16, substituting the flow rate of the replacement pre-rinse spray valve. Efficient pre-rinse spray valves use 1.3 gpm or less.

#### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing pre-rinse spray valve, identify the following information and use Equation 4-17:

- Current water use as calculated using Equation 4-16.
- Water use after replacement as calculated using Equation 4-16.

<sup>49</sup> U.S. Environmental Protection Agency's (EPA's) WaterSense program. March 31, 2011. *Pre-Rinse Spray Valves Field Study Report*. Page 19. [www.epa.gov/watersense/products/prsv.html](http://www.epa.gov/watersense/products/prsv.html).

## 4.8 Pre-Rinse Spray Valves

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**Equation 4-17. Water Savings From Pre-Rinse Spray Valve Replacement (gallons per year)**

**= Current Water Use of Pre-Rinse Spray Valve – Water Use of Pre-Rinse Spray Valve After Replacement**

Where:

- Current Water Use of Pre-Rinse Spray Valve (gallons per year)
  - Water Use of Pre-Rinse Spray Valve After Replacement (gallons per year)
- 

### *Payback*

To calculate the simple payback from the water savings associated with replacing an existing pre-rinse spray valve, consider the equipment cost of the replacement pre-rinse spray valve, the water savings as calculated using Equation 4-17, and the facility-specific cost of water and wastewater. Pre-rinse spray valves typically cost less than \$100.

By replacing a pre-rinse spray valve with a more efficient model, facilities can also save a significant amount of energy due to the reduction in hot water use. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

## **Additional Resources**

Alliance for Water Efficiency. Commercial Food Service Introduction. [www.allianceforwaterefficiency.org/Commercial\\_Food\\_Service\\_Introduction.aspx](http://www.allianceforwaterefficiency.org/Commercial_Food_Service_Introduction.aspx).

DOE, Energy Efficiency & Renewable Energy, Federal Energy Management Program. Covered Product Category: Pre-Rinse Spray Valves. [www1.eere.energy.gov/femp/technologies/eep\\_low-flow\\_valves.html](http://www1.eere.energy.gov/femp/technologies/eep_low-flow_valves.html).

EPA's WaterSense program. Pre-Rinse Spray Valves. [www.epa.gov/WaterSense/products/prsv.html](http://www.epa.gov/WaterSense/products/prsv.html).

Food Service Technology Center. Commercial Kitchen Equipment—Pre-Rinse Spray Valves. [www.fishnick.com/equipment/sprayvalves/](http://www.fishnick.com/equipment/sprayvalves/).

## 4.9 Food Disposals



*Garbage disposal with grinder*

### Overview

Scraping dishes and disposing of food waste prior to dishwashing can be a very water- and energy-intensive process, depending upon the food disposal method used. Typically, commercial kitchens dispose of food scraps using a garbage disposal with a grinder that processes food waste into pieces small enough to pass through the plumbing system.

Garbage disposals in and of themselves do not use water; however, kitchen staff often run water at high flow rates through the garbage disposal to prevent damage to the grinder blades and keep food waste from building up and clogging the plumbing system. Some facilities have a sluice trough, which feeds the garbage disposal and is usually built into a stainless steel table system. Water is applied continuously at the top of the trough, often at a rate of 2.0 to 15.0 gallons per minute (gpm),<sup>50</sup> depending upon how many nozzles are installed. Food waste is scraped into the trough and rinsed down into the garbage disposal. Alternatively, some facilities rinse food from dishes into a garbage disposal using a pre-rinse spray valve.

As an alternative to a traditional garbage disposal with a grinder, some facilities use food pulpers to collect and dispose of food scraps. Food pulpers are located where the grinder would otherwise be located. Unlike a traditional garbage disposal with a grinder, however, food pulpers crush food waste into a pulp (i.e., slurry), extract excess water from the pulp, then send the pulp waste to a bin for later disposal or composting. In many food pulper systems, the extracted water can be recycled within the food pulping process or reused to pre-rinse dishes or act as a sluice trough where food wastes are dumped. When a recirculation system is used, pulpers can recirculate 5.0 to 15.0 gpm through the system, needing only 2.0 gpm for make-up water.<sup>51</sup> Figure 4-6 illustrates the food pulping process.



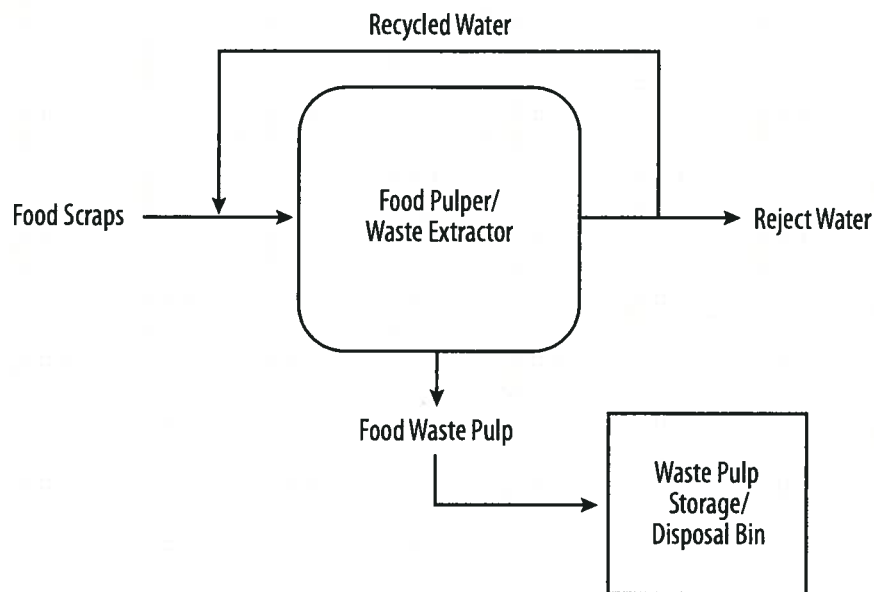
*Sluice trough*

<sup>50</sup> Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC. June 2010. *A Report on Potential Best Management Practices—Commercial Dishwashers*. Prepared for the California Urban Water Conservation Council. Pages 5-7. [www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

<sup>51</sup> *Ibid.*

## 4.9 Food Disposals

Figure 4-6. Food Pulper System Diagram



Food strainers are an alternative to traditional garbage disposals and food pulpers. As food scraps are rinsed from dishes, a scrap or strainer basket in the bottom of the sink captures the waste for later disposal or composting. Another type of combination system acts as both a food pulper and food strainer, recirculating water for pulping of food scraps and collecting food scraps in a strainer basket for later disposal.<sup>52</sup>

Before installing a new or replacing an existing food disposal system, consider any local restrictions on systems that discharge food waste to the sanitary sewer. Some areas have banned garbage disposals or have placed additional sewer charges on operations using them, due to concerns about increased loads on the local wastewater treatment plant.<sup>53</sup>

### Operation, Maintenance, and User Education

For optimal food disposal efficiency, consider the following:

- Where possible, turn off the water to the food disposal system during idle periods when the system is not in use and when the facility is closed.
- Scrape larger food scraps into a trash receptacle prior to rinsing food waste into the food disposal system. Consider composting food waste if appropriate. See the U.S. Environmental Protection Agency's (EPA's) composting Web page<sup>54</sup> for more information.
- Do not pour grease into the food disposal system. Doing so can clog pipes over time.
- Do not place any hard objects into the food disposal system. This can dull the blades, reducing the unit's efficiency.

<sup>52</sup> *Ibid.*

<sup>53</sup> *Ibid.*

<sup>54</sup> U.S. Environmental Protection Agency (EPA). Composting of Organic Materials. [www.epa.gov/osw/conservation/materials/organics/food/fd-compost.htm](http://www.epa.gov/osw/conservation/materials/organics/food/fd-compost.htm).



## 4.9 Food Disposals

- Run cold water through the food disposal system instead of hot water. This will reduce the energy use associated with heating the water. It will also help to keep the system cool.
- Regularly inspect and clean the food disposal system to make sure the blades are sharp and the system is not clogged with debris.

### Retrofit Options

To reduce the water use associated with a traditional garbage disposal, consider installing a device that can sense the disposal motor's load and regulate the amount of water necessary. These devices can reduce the idle flow rate when the garbage disposal is not in use, from between 2.0 and 15.0 gpm to 1.0 gpm, thus saving a significant amount of water. Also, consider installing a timer to stop the flow of water to the garbage disposal after 15 minutes, so that the user must periodically reactivate the system.<sup>55</sup>

### Replacement Options

When purchasing a new food disposal system or looking to replace an existing food disposal system, consider these options:

- Purchase a garbage disposal with a load sensor to regulate the amount of water conveyed through the disposal depending upon whether it is in use or idling.
- Install a food pulper or food pulper/strainer combination system, which can recycle 75 percent of the water used for the food disposal process.
- Replace mechanical food disposal systems with food strainers, which use little to no water.

### Savings Potential

Conventional garbage disposals can use a constant water flow of 2.0 to 15.0 gpm when in use. This water use can be significantly reduced either by retrofitting with a load sensor to regulate and reduce the amount of water used by the existing garbage disposal during idle mode, or by replacing the garbage disposal with a food pulper or food strainer. To estimate facility-specific water savings and payback, use the following information.

#### Conventional Garbage Disposal Retrofit

Water use can be reduced by retrofitting an existing conventional garbage disposal with a load sensor. Load sensors can reduce the flow rate through the garbage disposal to as little as 1.0 gpm when the garbage disposal is not in use (i.e., during idle periods). Water savings from the reduction in flow rate during idle use can be calculated.

<sup>55</sup> East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD9-11. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).



## 4.9 Food Disposals

### *Current Water Use*

To estimate the current water use of an existing garbage disposal during idle periods, identify the following information and use Equation 4-18:

- Flow rate of water through the garbage disposal. This flow rate typically ranges from 2.0 to 15.0 gpm.
- Average daily idle period of the garbage disposal. Idle period is the time when the garbage disposal is turned on but not in use. While this will vary by facility, some estimates indicate that garbage disposals are typically used three hours per day. For a facility operating 12 hours a day, this would mean an idle period of nine hours if the garbage disposal is kept on throughout the day.<sup>56</sup>
- Days of facility operation per year.

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**Equation 4-18. Water Use of Garbage Disposal During Idle Periods (gallons per year)**

$$\text{= Flow Rate Through Garbage Disposal} \times \text{Daily Idle Period} \times \text{Days of Facility Operation}$$

Where:

- Flow Rate Through Garbage Disposal (gallons per minute)
  - Daily Idle Period (minutes per day)
  - Days of Facility Operation (days per year)
- 

### *Water Use After Retrofit*

To estimate the water use from an existing garbage disposal that is retrofitted with a load sensor during idle period, use Equation 4-18, substituting the reduced idle flow rate. A load sensor can reduce the idle flow rate when the garbage disposal is not in use to as little as 1.0 gpm.

### *Water Savings*

To calculate the water savings that can be achieved from retrofitting an existing conventional garbage disposal, identify the following and use Equation 4-19:

- Current water use as calculated using Equation 4-18.
- Water use after retrofit as calculated using Equation 4-18.

<sup>56</sup> Ibid.

## 4.9 Food Disposals

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### Equation 4-19. Water Savings From Garbage Disposal Retrofit (gallons per year)

$$= \text{Current Water Use of Garbage Disposal During Idle Periods} - \text{Water Use of Garbage Disposal During Idle Periods After Retrofit}$$

Where:

- Current Water Use of Garbage Disposal During Idle Periods (gallons per year)
  - Water Use of Garbage Disposal During Idle Periods After Retrofit (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with retrofitting an existing conventional garbage disposal with a load sensor, consider the equipment and installation cost of the retrofit load sensor, the water savings as calculated in Equation 4-19, and the facility-specific cost of water and wastewater.

Because garbage disposals may use hot water, a reduction in water use could also result in energy savings. Reducing the use time of the garbage disposal can also save energy. The potential energy savings may further reduce the payback period and increase the cost-effectiveness.

#### **Conventional Garbage Disposal Replacement—Food Pulper**

Conventional garbage disposals can be replaced with a food pulper. A food pulper can recycle and reuse 75 percent of the water used for the food disposal process, thus reducing the flow rate of fresh water required to run through the garbage disposal unit.

#### *Current Water Use*

To estimate the current water use of an existing garbage disposal, identify the following information and use Equation 4-20:

- Flow rate of water through the garbage disposal. This flow rate typically ranges from 2.0 to 15.0 gpm.
- Average daily use time of the garbage disposal.
- Days of facility operation per year.

## 4.9 Food Disposals

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### Equation 4-20. Water Use of Garbage Disposal (gallons per year)

$$= \text{Flow Rate Through Garbage Disposal} \times \text{Daily Use Time} \times \text{Days of Facility Operation}$$

Where:

- Flow Rate Through Garbage Disposal (gallons per minute)
  - Daily Use Time (minutes per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Replacement*

To estimate the water use of a replacement food pulper, use Equation 4-20, substituting the flow rate of fresh water through the food pulper. Freshwater flow rate through a food pulper that recirculates water for pre-rinsing is typically 2.0 gpm.<sup>57</sup>

#### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing conventional garbage disposal with a food pulper, identify the following information and use Equation 4-21:

- Current water use as calculated using Equation 4-20.
- Water use after replacement as calculated using Equation 4-20.

---

### Equation 4-21. Water Savings From Garbage Disposal Replacement (gallons per year)

$$= \text{Current Water Use of Garbage Disposal} - \text{Water Use of Garbage Disposal After Replacement}$$

Where:

- Current Water Use of Garbage Disposal (gallons per year)
  - Water Use of Garbage Disposal After Replacement (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water savings associated with replacing a garbage disposal with a food pulper, consider the equipment and installation cost of the food pulper, the water savings as calculated in Equation 4-21, and the facility-specific cost of water and wastewater.

Because garbage disposals can use hot water, a reduction in water use could also result in energy savings, which can further reduce the payback period and increase the cost-effectiveness.

<sup>57</sup> Ibid.

## 4.9 Food Disposals

### **Conventional Garbage Disposal Replacement—Food Strainer**

Conventional garbage disposals can be replaced with a food strainer. Because a food strainer does not use water for the grinding/food disposal process, installing a food strainer to replace an existing garbage disposal can eliminate this water use.

#### *Current Water Use*

To estimate the current water use of an existing garbage disposal, use Equation 4-20.

#### *Water Use After Replacement*

A food strainer can completely eliminate the use of water for the grinding/food disposal process.

#### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing conventional garbage disposal with a food strainer, use Equation 4-21. In this case, water savings will be exactly equal to the current water use because the replacement food strainer uses no water.

#### *Payback*

To calculate the simple payback from the water savings associated with replacing a garbage disposal with a food strainer, consider the equipment and installation cost of the food strainer, the water savings as calculated in Equation 4-21, and the facility-specific cost of water and wastewater.

Because garbage disposals can use hot water, a reduction in water use could also result in energy savings. Eliminating the use of the garbage disposal may also save energy. The potential energy savings could further reduce the payback period and increase the cost-effectiveness.

### **Additional Resources**

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD9-11. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC. June 2010. *A Report on Potential Best Management Practices—Commercial Dishwashers*. Prepared for the California Urban Water Conservation Council. Pages 5-7. [www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

## 4.10 Commercial Dishwashers

### Overview

Commercial dishwashers are one of the largest water users in commercial kitchens. They clean and sanitize plates, glasses, bowls, utensils, and other food service ware. These machines can account for more than one-third of the overall water use in a commercial kitchen.<sup>58</sup> Commercial dishwasher design can vary greatly by application, depending on the how many employees, visitors, and/or customers are served by the commercial kitchen (i.e., the amount of facility throughput).

The most efficient commercial dishwashers reuse water from one wash load to the next, using one or more holding tanks. This not only reduces water use, but also reduces the amount of energy required to heat additional water. Alternatively, fill-and-dump commercial dishwashers discard water after each load, making this type of commercial dishwasher inherently less efficient.

The basic design of commercial dishwashers varies. Commercial dishwasher design can be separated into several categories:

- Undercounter
- Stationary door- or hood-type
- Conveyor-type
- Flight-type

Smaller facilities serving fewer than 60 people per day often use undercounter dishwashers, which are similar to residential dishwashers and tend to be smaller in size.

Stationary door- or hood-type commercial dishwashers are used for slightly larger throughputs of 150 people per day. These are usually manually front-loaded with racks (generally 20 inches by 20 inches in size) that contain dishes and other kitchenware.

Conveyor-type machines also wash dishes that are manually loaded on removable racks; however, multiple racks can be washed at a time, and the racks are pulled through the washer using a conveyor to complete each cycle. The conveyor is typically turned off between loads. These types of machines are ideal for larger service facilities serving up to 300 people per day.

Flight-type machines are used in facilities with the highest throughputs. They also use a conveyor, but instead of loading racks full of dishes onto the conveyor, the conveyor itself serves as a rack, and dishes are loaded onto the pegs or fingers of the conveyor rack as it comes around. The conveyor is typically continuously moving as dishes are loaded, washed, and removed.<sup>59</sup>



*Stationary hood-type dishwasher*

<sup>58</sup> Alliance for Water Efficiency. Commercial Dishwashing Introduction. [www.allianceforwaterefficiency.org/commercial\\_dishwash\\_intro.aspx?terms=commercial+dishwasher](http://www.allianceforwaterefficiency.org/commercial_dishwash_intro.aspx?terms=commercial+dishwasher).

<sup>59</sup> Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC. June 2010. *A Report on Potential Best Management Practices—Commercial Dishwashers*. Prepared for the California Urban Water Conservation Council. [www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

## 4.10 Commercial Dishwashers



*Rack conveyor-type dishwasher*

There are no federal standards limiting the water or energy consumption of commercial dishwashers. The U.S. Environmental Protection Agency (EPA) and the U.S. Energy Department's (DOE's) ENERGY STAR® qualifies energy- and water-efficient commercial dishwashers,<sup>60</sup> including undercounter, stationary single-tank door-, and conveyor- (single- and multi-stage tank-) type machines.

ENERGY STAR specifies that commercial dishwashers demonstrate a maximum water consumption in gallons per rack in order to qualify for the ENERGY STAR. ENERGY STAR qualified commercial dishwashers can reduce both energy and water use by 25 percent.

### Operation, Maintenance, and User Education

For optimal commercial dishwasher efficiency, consider the following:

- Only run dishwashers when they are full. Each dishwasher rack should be filled to maximum capacity.
- Educate staff to scrape dishes prior to loading the dishwasher.
- Replace any damaged dishwasher racks.
- Ensure that the final rinse pressure and water temperature are within the manufacturer's recommendations.
- Operate the dishwasher close to or at the minimum flow rate recommended by the manufacturer. Set the rinse cycle time to the manufacturer's minimum recommended setting and periodically verify that the machine continues to operate with that rinse cycle time.
- Turn off machines at night when not in use.
- Make sure that manual fill valves close completely after the wash tank is filled.
- Find and repair any leaks. Inspect valves and rinse nozzles for proper operation and repair worn nozzles.

For conveyor-type machines, these further steps can be taken to ensure optimal efficiency:

- Install and/or maintain wash curtains. Wash curtains are able to retain heat within the machine.
- Ensure the rinse bypass drain is properly adjusted so that the wash tank is adequately replenished during operation.

<sup>60</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Commercial Dishwashers Key Product Criteria. [www.energystar.gov/index.cfm?c=comm\\_dishwashers.pr\\_crit\\_comm\\_dishwashers](http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers).



## 4.10 Commercial Dishwashers

- Operate conveyor-type machines in auto-mode. This will save energy by running the conveyor motor only when needed.

### Retrofit Options

Efficient retrofit options are available for conveyor-type dishwasher units. When retrofitting an existing conveyor-type dishwasher, consider installing rack sensors that allow water flow only when dishes are present, saving water by initiating the cleaning cycle less frequently.

### Replacement Options

When purchasing or leasing a new commercial dishwasher or replacing an existing commercial dishwasher, look for ENERGY STAR qualified models,<sup>61</sup> which save water, conserve energy, and reduce overall operating costs. For flight-type dishwashers, which do not qualify for the ENERGY STAR, choose equipment with a water use of less than 0.01 gallons per dish.<sup>62</sup> In addition, choose models that reuse rinse water, if possible, as opposed to traditional fill-and-dump machines.

Be sure to consider the typical kitchen throughput to select an appropriately sized commercial dishwasher. A commercial dishwasher that is larger than necessary will waste water if the machine is not loaded to capacity.

### Savings Potential

ENERGY STAR qualified commercial dishwashers use 25 percent less water than conventional models, on average. Use ENERGY STAR's commercial kitchen equipment savings calculator<sup>63</sup> to estimate facility-specific water, energy, and cost savings for replacing an existing commercial dishwasher with an ENERGY STAR qualified model.

The Food Service Technology Center also has a life cycle and energy cost calculator,<sup>64</sup> which can be used to calculate the savings potential from replacing many types of commercial kitchen equipment, including commercial dishwashers.

Depending upon the type of machine, a range of water and energy savings can be achieved. To estimate facility-specific water savings and payback, the facility can also use the following information.

#### *Current Water Use*

To estimate the water use of a commercial dishwasher, identify the following information and use Equation 4-22:

- Water use per rack washed.
- Average estimate of racks washed per day.
- Days of facility operation per year.

<sup>61</sup> *Ibid.*

<sup>62</sup> Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.*

<sup>63</sup> EPA and DOE's ENERGY STAR. Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment. [www.energystar.gov/ia/business/bulk\\_purchasing/bpsavings\\_calc/commercial\\_kitchen\\_equipment\\_calculator.xls](http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls).

<sup>64</sup> Food Service Technology Center. Commercial Foodservice Equipment Lifecycle Cost Calculator. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

## 4.10 Commercial Dishwashers

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### Equation 4-22. Water Use of Commercial Dishwasher (gallons per year)

$$\text{= Water Use per Rack} \times \text{Racks Washed per Day} \times \text{Days of Facility Operation}$$

Where:

- Water Use per Rack (gallons per rack)
  - Racks Washed per Day (racks per day)
  - Days of Facility Operation (days per year)
- 

#### *Water Use After Replacement*

To estimate the water use after replacing an existing commercial dishwasher with an ENERGY STAR qualified commercial dishwasher, use Equation 4-22, substituting the water use per rack washed of the new machine. ENERGY STAR specifies maximum water consumption rates per rack for undercounter, stationary single-tank door-, single-tank conveyor-, and multiple-tank conveyor-type machines.<sup>65</sup>

#### *Water Savings*

To calculate water savings that can be achieved from replacing an existing commercial dishwasher, identify the following and use Equation 4-23:

- Current water use as calculated using Equation 4-22.
  - Water use after retrofit as calculated using Equation 4-22.
- 

### Equation 4-23. Water Savings From Dishwasher Replacement (gallons per year)

$$\text{= Current Water Use of Dishwasher} - \text{Water Use of Dishwasher After Replacement}$$

Where:

- Current Water Use of Dishwasher (gallons per year)
  - Water Use of Dishwasher After Replacement (gallons per year)
- 

#### *Payback*

To calculate the simple payback from the water use associated with replacing an existing commercial dishwasher, consider the equipment and installation cost of the ENERGY STAR qualified commercial dishwasher, the water savings as calculated in Equation 4-23, and the facility-specific cost of water and wastewater.

ENERGY STAR qualified commercial dishwashers also use less energy due to lower idle energy rates and a reduction in the use of hot water. This energy savings will further reduce the payback period and increase replacement cost-effectiveness.

<sup>65</sup> EPA and DOE's ENERGY STAR. Commercial Dishwashers Key Product Criteria, *op. cit.*

## 4.10 Commercial Dishwashers

### Additional Resources

Alliance for Water Efficiency. Commercial Dishwashing Introduction. [www.allianceforwaterefficiency.org/commercial\\_dishwash\\_intro.aspx?terms=commercial+dishwashers+introduction](http://www.allianceforwaterefficiency.org/commercial_dishwash_intro.aspx?terms=commercial+dishwashers+introduction).

Consortium for Energy Efficiency, Inc. 2010. *High Efficiency Specifications for Commercial Dishwashers*. [www.cee1.org/com/com-kit/com-kit-equip.php3](http://www.cee1.org/com/com-kit/com-kit-equip.php3).

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD12-14. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

EPA and DOE's ENERGY STAR. Commercial Dishwashers. [www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=COH](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COH).

Food Service Technology Center (FSTC). Commercial Foodservice Equipment Life-cycle Cost Calculators. [www.fishnick.com/saveenergy/tools/calculators/](http://www.fishnick.com/saveenergy/tools/calculators/).

FSTC. Dishwashing Machines. [www.fishnick.com/savewater/appliances/dishmachines/](http://www.fishnick.com/savewater/appliances/dishmachines/).

Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC. June 2010. *A Report on Potential Best Management Practices—Commercial Dishwashers*. Prepared for the California Urban Water Conservation Council. [www.cuwcc.org/products/pbmp-reports.aspx](http://www.cuwcc.org/products/pbmp-reports.aspx).

North Carolina Division of Pollution Prevention and Environmental Assistance. May 2009. *Water Efficiency, Water Management Options, Kitchen and Food Preparation*. Pages 2-4. [www.savewaternc.org/busresources.php](http://www.savewaternc.org/busresources.php).

## 4.11 Wash-Down Sprayers



### Overview

Wash-down sprayers are hoses used for a variety of cleaning purposes, including washing countertops, floors, mats, and other kitchen areas. Wash-down sprayers use large volumes of water to provide a high-pressure stream capable of cleaning dirt and residue from surfaces.

A wash-down sprayer features a nozzle attached to a hose, which is connected to the water supply. Wash-down sprayers typically deliver flow rates of 7.0 gallons per minute (gpm),<sup>66</sup> while heavy-duty hoses can deliver higher flow rates from 9.0 to 20.0 gpm.<sup>67</sup>

Because wash-down sprayers use large volumes of water to perform cleaning tasks, using another cleaning method could be a viable alternative. These alternative cleaning methods (e.g., mopping, sweeping) are able to perform the same tasks, yet require significantly less water or no water at all. If implementing new cleaning methods is not feasible, replacement options exist that use lower flow rates than wash-down sprayers, including pressure washers and water brooms.

### Operation, Maintenance, and User Education

For optimal wash-down sprayer efficiency, consider the following:

- Only use wash-down sprayers to clean floors, countertops, and other surfaces. Do not use wash-down sprayers to clean dishware, which should be cleaned with pre-rinse spray valves.
- If the wash-down sprayer does not have a self-closing nozzle, shut off the water supply when the sprayer is not in use.
- For floor washing applications, consider using a broom and dust pan to clean up solid waste and/or using a mop and squeegee instead of a wash-down sprayer.

### Retrofit Options

If a high-flowing wash-down sprayer hose is used without a nozzle, consider installing a self-closing nozzle. This can reduce the flow rate of the wash-down sprayer from up to 20.0 gpm down to 7.0 gpm and prevent water from being wasted when the wash-down sprayer is not in use.

### Replacement Options

There are several replacement options for wash-down sprayers. For certain applications, wash-down sprayers can be replaced with mopping or sweeping, which require little to no water use.

<sup>66</sup> Food Service Technology Center (FSTC). 2010. *Water Conservation Measures for Commercial Food Service*. [www.fishnick.com/savewater/bestpractices](http://www.fishnick.com/savewater/bestpractices).

<sup>67</sup> U.S. Environmental Protection Agency (EPA) and U.S. Energy Department's (DOE's) ENERGY STAR. Best Practices—How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities. [www.energystar.gov/index.cfm?c=healthcare.fisher\\_nickel\\_feb\\_2005](http://www.energystar.gov/index.cfm?c=healthcare.fisher_nickel_feb_2005).

## 4.11 Wash-Down Sprayers

Pressure washers serve as good replacement options for facilities that rely on the washing ability of wash-down sprayers. Pressure washers typically have flow rates of 3.0 gpm or less at high pressure and often perform better than wash-down sprayers.

For floor cleaning applications, water brooms can replace existing wash-down sprayers. Water brooms have wide spray patterns with multiple jets that can clean more efficiently than a wash-down sprayer and use significantly less water.<sup>68</sup>

### Savings Potential

Water savings can be achieved through wash-down sprayer retrofit or replacement. Existing high-flowing wash-down sprayers can be retrofitted with a self-closing nozzle. Wash-down sprayers can be replaced with a pressure washer or water broom.

To estimate facility-specific savings and payback, use the following information.

#### Wash-Down Sprayer Retrofit

Wash-down sprayers typically deliver flow rates of 7.0 gallons per minute (gpm),<sup>69</sup> while heavy-duty hoses can deliver higher flow rates from 9.0 to 20.0 gpm.<sup>70</sup>

#### Current Water Use

To estimate the current water use of an existing wash-down sprayer, identify the following information and use Equation 4-24:

- Flow rate of the existing, high-flowing wash-down sprayer. Most high-flowing wash-down sprayers have flow rates between 9 and 20 gpm.<sup>71</sup>
- Average daily use time.
- Days of facility operation per year.

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**Equation 4-24. Water Use of Wash-Down Sprayer or Water Broom (gallons per year)**

**= Flow Rate of Wash-Down Sprayer or Water Broom x Daily Use Time x Days of Facility Operation**

Where:

- Flow Rate of Wash-Down Sprayer or Water Broom (gallons per minute)
  - Daily Use Time (minutes per day)
  - Days of Facility Operation (days per year)
- 

<sup>68</sup> FSTC, *op. cit.*

<sup>69</sup> *Ibid.*

<sup>70</sup> EPA and DOE's ENERGY STAR, *op. cit.*

<sup>71</sup> *Ibid.*

## 4.11 Wash-Down Sprayers

### *Water Use After Retrofit*

To estimate the water use after retrofitting an existing wash-down sprayer with a nozzle, use Equation 4-24, substituting the flow rate of the retrofit nozzle. Self-closing nozzles often flow at a rate of 7.0 gpm.<sup>72</sup>

### *Water Savings*

To calculate the water savings that can be achieved from retrofitting an existing wash-down sprayer with a nozzle, identify the following information and use Equation 4-25:

- Current water use as calculated using Equation 4-24.
- Water use after retrofit as calculated using Equation 4-24.

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### **Equation 4-25. Water Savings From Wash-Down Sprayer Retrofit or Replacement (gallons per year)**

$$\text{= Water Use of Wash-Down Sprayer – Water Use After Retrofit or Replacement}$$

Where:

- Current Water Use of Wash-Down Sprayer (gallons per year)
  - Water Use After Retrofit or Replacement (gallons per year)
- 

### *Payback*

To calculate the simple payback from the water savings associated with the wash-down sprayer retrofit, consider the equipment and installation cost of the retrofit self-closing nozzle, the water savings as calculated using Equation 4-25, and the facility-specific cost of water and wastewater. Self-closing nozzles typically cost \$100.

### **Wash-Down Sprayer Replacement**

A pressure washer or water broom typically uses 2.0 gpm, while heavy-duty hoses can deliver higher flow rates from 9.0 to 20.0 gpm.<sup>73</sup>

### *Current Water Use*

To estimate the current water use of an existing wash-down sprayer, use Equation 4-24.

<sup>72</sup> FSTC, *op. cit.*

<sup>73</sup> EPA and DOE's ENERGY STAR, *op. cit.*



## 4.11 Wash-Down Sprayers

### *Water Use After Replacement*

To estimate the water use of a replacement pressure washer or water broom, use Equation 4-24, substituting the flow rate of the water broom. Water brooms can use as little as 2.0 gpm.<sup>74</sup> Pressure washers flow at similar flow rates using high water pressure.

### *Water Savings*

To calculate the water savings that can be achieved from replacing an existing wash-down sprayer with a pressure washer or water broom, use Equation 4-25.

### *Payback*

To calculate the simple payback from the water savings associated with replacing the wash-down sprayer with a pressure washer or water broom, consider the equipment and installation cost of the replacement, the water savings as calculated using Equation 4-25, and the facility-specific cost of water and wastewater. Pressure washers and water brooms typically cost \$100.

## Additional Resources

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages FOOD8-9. [www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook](http://www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook).

EPA and DOE's ENERGY STAR. Best Practices—How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities. [www.energystar.gov/index.cfm?c=healthcare.fisher\\_nickel\\_feb\\_2005](http://www.energystar.gov/index.cfm?c=healthcare.fisher_nickel_feb_2005).

Food Service Technology Center (FSTC). 2010. *Water Conservation Measures for Commercial Food Service*. [www.fishnick.com/savewater/bestpractices](http://www.fishnick.com/savewater/bestpractices).

FSTC. April 2005. *Green Sheet: Water, Water Everywhere and Not a Drop to Waste*. [www.fishnick.com/saveenergy/greensheets/GreenSheet\\_Water\\_Waste\\_1.pdf](http://www.fishnick.com/saveenergy/greensheets/GreenSheet_Water_Waste_1.pdf).

<sup>74</sup> FSTC, *op. cit.*

